ILM TERMINAL IMPROVEMENTS
CONTRACT 2

WILMINGTON INTERNATIONAL AIRPORT
1740 AIRPORT BOULEVARD, SUITE 12
WILMINGTON, NC 28405

PROJECT MANUAL

NOVEMBER 30, 2018



Architect: The Wilson Group
Project Manager & Civil Engineer: Talbert & Bright
Consulting Architect: LS3P
Structural Engineer: Stewart
P, M, & E Engineer: Cheatham & Associates, P.A.
Baggage Handling Consultants: BNP
Specialty Lighting Consultant: Hartranft
Signage & Wayfinding: Takeform

Volume 1 of 2

DOCUMENT 000107 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

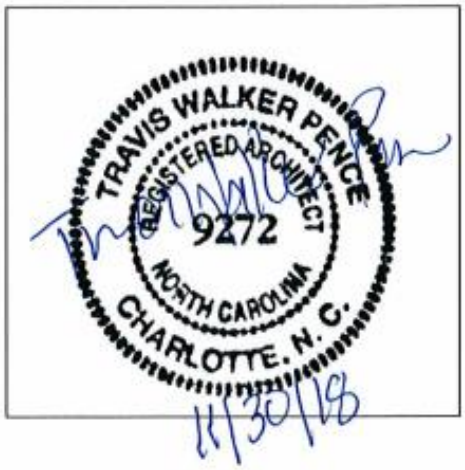
The Wilson Group Architects
2113 Commonwealth Avenue
Charlotte, NC 28205
Phone: 704.331.9747
NC Certificate No. 51140

Responsible for Specifications Sections accompanied by "The Wilson Group" in the header area of the document and not otherwise prepared by other design professionals of record.



Travis Walker Pence, AIA
NC License 9272

Responsible for Specifications Sections accompanied by "The Wilson Group" in the header area of the document and not otherwise prepared by other design professionals of record.



B. Consulting Architect:

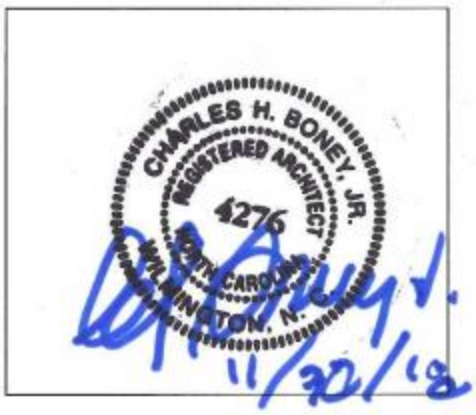
LS3P Associates Ltd.
101 N. Third Street, Suite 500
Wilmington, NC 28401
Phone: 910.790.9901
NC Certificate No. 50417

Responsible for Specifications Sections accompanied by "LS3P" in the header area of the document and not otherwise prepared by other design professionals of record.



Charles H. Boney, Jr., FAIA
NC License 4276

Responsible for Specifications Sections accompanied by "LS3P" in the header area of the document and not otherwise prepared by other design professionals of record.



C. Civil Engineer:

Talbert & Bright
4810 Shelley Drive
Wilmington, NC 28405
Phone: 910.763.5350
Firm No. NC C-0713

Eric Stumph, PE
NC License 024169

Responsible for Specifications Sections accompanied by "Talbert & Bright" in the header area of the document and not otherwise prepared by other design professionals of record.

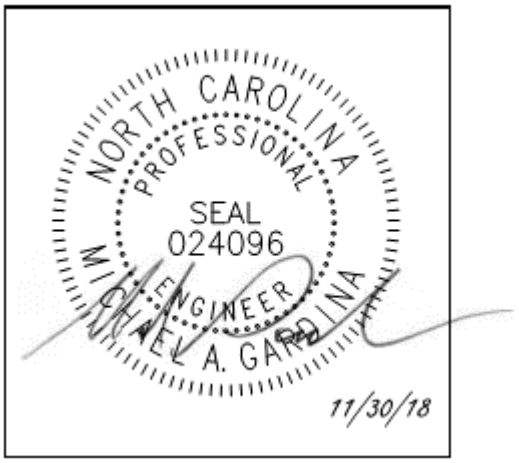


D. Structural Engineer:

Stewart
101 N. Tryon Street, Suite 1400
Charlotte, NC 28202
Phone: 704.373.1907
Firm No. NC C-1051

Michael A. Gardina, PE
NC License 24096

Responsible for Specifications Sections accompanied by "Stewart" in the header area of the document and not otherwise prepared by other design professionals of record.



E. Fire-Protection/Plumbing Engineer:

Cheatham & Associates, PA
3412 Enterprise Drive
Wilmington, North Carolina 28405
Phone: 910.452.4210
Firm No. NC C-1073

Casey D. Gilman, PE
NC License 043164

Responsible for Specifications Sections accompanied by "Cheatham & Associates" in the header area of the document and not otherwise prepared by other design professionals of record.

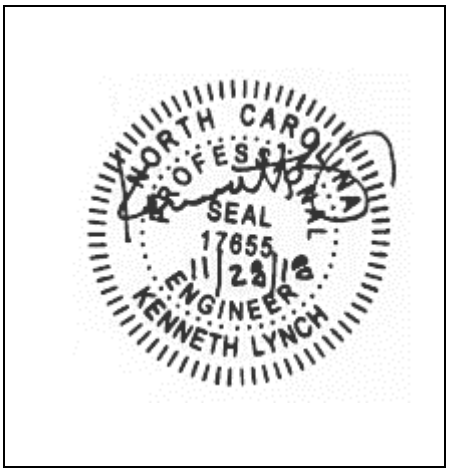


F. HVAC Engineer:

Cheatham & Associates, PA
3412 Enterprise Drive
Wilmington, North Carolina 28405
Phone: 910.452.4210
Firm No. NC C-1073

Kenneth Lynch, PE
NC License 17655

Responsible for Specifications Sections accompanied by "Cheatham & Associates" in the header area of the document and not otherwise prepared by other design professionals of record.



G. Electrical Engineer:

Cheatham & Associates, PA
3412 Enterprise Drive
Wilmington, North Carolina 28405
Phone: 910.452.4210
Firm No. NC C-1073

Mark A. Ciarrocca, PE
NC License 17593

Responsible for Specifications Sections accompanied by "Cheatham & Associates" in the header area of the document and not otherwise prepared by other design professionals of record.



END OF DOCUMENT 000107

SECTION 000110 - TABLE OF CONTENTS

VOLUME ONE

BIDDING INFORMATION

Advertisement for Bids (Previously Published)
Invitation to Bid
Instructions to Bidders - AIA Document A701- 1997
Supplementary Instructions to Bidders
Baggage Handling System (BHS) Price Schedule
Baggage Handling System (BHS) Unit Pricing
Bidder's Request for Information Form
Bidder's Request for Substitution Form
Bid Form

MBE GUIDELINES AND FORMS

Important Notice to Bidders
Bid Conditions
Report of Participating Subcontractors and Suppliers
Certification of Competitive Bids
NHC MBE Subcontractor Contact Schedule
Good Faith Effort Affidavit

PROJECT INFORMATION

003132 Project Information
Geotechnical Engineering Report
Report of Pavement and Subsurface Investigation
Report of Subsurface Investigation Duct Bank Near Outbound Baggage
Report of SUE Results
July 2018 Airline Schedule

CONTRACT DOCUMENTS

New Hanover County Airport Authority Contract

DIVISION 1 - GENERAL REQUIREMENTS

011000 Summary
E-Verify Affidavit
Federal Contract Provisions
Section 10 - General Conditions - Definition of Terms
Section 20 - General Conditions - Proposal Requirements and Conditions
Section 30 - General Conditions - Award and Execution of Contract
Section 40 - General Conditions - Scope of Work
Section 50 - General Conditions - Control of Work
Section 60 - General Conditions - Control of Materials
Section 70 - General Conditions - Legal Regulations and Responsibility to Public
Section 80 - General Conditions - Execution and Progress
Section 90 - General Conditions - Measurement and Payment
012100 Allowances
012200 Unit Prices
012300 Alternates
012500 Substitution Procedures

Contractor's Request for Substitution Form
012600 Contract Modification Procedures
Change Proposal Worksheet Summary
012900 Payment Procedures
013100 Project Management and Coordination
013200 Construction Progress Documentation
013233 Photographic Documentation
013300 Submittal Procedures
Digital Data Letter of Agreement
013516 Alteration Project Procedures
014000 Quality Requirements
014100 Special Inspections
014200 References
015000 Temporary Facilities and Controls
016000 Product Requirements
017300 Execution
017419 Construction Waste Management and Disposal
017700 Closeout Procedures
017823 Operation and Maintenance Data
017836 Warranties
017839 Project Record Documents
017900 Demonstration and Training

DIVISION 02 - EXISTING CONDITIONS AND SITEWORK

020050 Civil Project Special Provisions
020100 Civil Construction
020152 Earthwork
020162 Chain-Link Fence
020501 Portland Cement Concrete (PCC) Pavement
020605 Joint Sealants for Concrete Pavements
020620 Taxilane and Apron Marking
020660 Water Distribution
020701 Pipe for Storm Drains
020751 Manholes, Catch Basins and Inlets
024119 Selective Demolition

DIVISION 03 - CONCRETE

033000 Cast-In-Place Concrete

DIVISION 04 - MASONRY

042000 Unit Masonry

DIVISION 05 - METALS

051200 Structural Steel Framing
053100 Steel Decking
054000 Cold-Formed Metal Framing
055000 Metal Fabrications
055213 Pipe and Tube Railings

DIVISION 06 - WOOD, PLASTICS AND COMPOSITES

061053 Miscellaneous Rough Carpentry
061600 Sheathing

062023 Interior Finish Carpentry
064116 Plastic-Laminate-Faced Architectural Cabinets
064600 Wood Trim

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

072100 Thermal Insulation
072119 Foamed-In-Place Insulation
074213.13 Formed Metal Wall Panels
074213.19 Insulated Metal Wall Panels
075419 Polyvinyl-Chloride (PVC) Roofing
076200 Sheet Metal Flashing and Trim
077100 Roof Specialties
078100 Applied Fireproofing
078200 Board Fireproofing
078413 Penetration Firestopping
078446 Fire-Resistive Joint Systems
079200 Joint Sealants

DIVISION 08 - OPENINGS

081113 Hollow Metal Doors and Frames
081416 Flush Wood Doors
083113 Access Doors and Frames
083323 Overhead Coiling Doors
084113 Aluminum-Framed Entrances and Storefronts
087100 Door Hardware
088000 Glazing
089119 Fixed Louvers

DIVISION 09 - FINISHES

092216 Non-Structural Metal Framing
092900 Gypsum Board
093013 Ceramic Tiling
095113 Acoustical Panel Ceilings
096513 Resilient Base and Accessories
096520 Resilient Plank Flooring
096536 Static-Control Resilient Flooring
096623 Resinous Matrix Terrazzo Flooring
096813 Tile Carpeting
097000 Wall Finishes
099113 Exterior Painting
099123 Interior Painting

DIVISION 10 - SPECIALTIES

101423 Room-Identification Signage
102600 Wall Protection
104400 Fire Protection Specialties
105113 Metal Lockers

DIVISION 12 - FURNISHINGS

122413 Roller Window Shades
123661 Quartz Agglomerate Countertops

VOLUME TWO

DIVISION 21 - FIRE SUPPRESSION

210000 Fire Protection

DIVISION 22 - PLUMBING

220000 Plumbing

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

230500 Heating and Air Conditioning
230900 Instrumentation and Control for HVAC

DIVISION 26 - ELECTRICAL

260000 Electrical, Basics
260500 Basic Electrical Materials and Methods
260519 Conductors and Cables
260526 Grounding and Bonding
260533 Raceways and Boxes
260538 Wire Mesh Cable Trays
260548 Seismic Controls for Electrical Systems
260553 Electrical Identification
260923 Lighting Control Devices
260943 Network Lighting Controls
262200 Dry-Type Transformers (600 V and Less)
262416 Panelboards
262726 Wiring Devices
262816 Enclosed Switches and Circuit Breakers
264113 Lightning Protection for Structures
264313 Surge Protective Devices
265119 LED Interior Lighting

DIVISION 27 - COMMUNICATIONS

271100 Communications Equipment Room Fittings
271300 Communications Backbone Cabling
271500 Communications Horizontal Cabling
275116 Public Address System

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

281500 Access Control System and Security Monitoring
282300 Video Surveillance System
283111 Digital, Addressable Fire-Alarm System

DIVISION 31 - EARTHWORK

313116 Termite Control

DIVISION 34 - TRANSPORTATION

347739 Baggage Conveying Equipment

END OF TABLE OF CONTENTS

ADVERTISEMENT

Notice to Bidders

Sealed bids, subject to the conditions herein, will be received until **11:00 a.m.** (local time), **Tuesday, January 29, 2019,** in the conference room of the Wilmington International Airport, 1740 Airport Boulevard, Suite 12, Wilmington, North Carolina, and then opened and publicly read for furnishing all labor and materials and performing all work connected with: **Terminal Improvements - Contract 2**, as indicated in the plans and specifications dated November 30, 2018.

A Pre-Bid Meeting will be held at 3:00 p.m. (local time), Tuesday, December 11, 2018 in the conference room of the Wilmington International Airport. Attendance at the Pre-Bid meeting is NOT mandatory, however is strongly recommended. A site visit will be available following the meeting. Portions of the project are located in the Airport Security Area where escorts are required for site visits. Contact Eric Stumph at Talbert & Bright (910-763-5350; estumph@tbiilm.com) with requests to schedule a site visit.

The project shall consist of furnishing all labor, materials and equipment and performing all work required to satisfactorily complete the project, which consists of phased renovation and expansion of the ticket lobby and airline offices, phased installation of new outbound baggage handling system (BHS) equipment in the Airport's passenger terminal, and phased demolition of existing BHS equipment. The project also includes mechanical, electrical, plumbing, fire protection, structural and civil work items related to the renovation and expansion of the Ticket Lobby and the BHS installation; and provision of SIDA-badged baggage porters to assist airlines and TSA in baggage handling operations during construction.

In accordance with North Carolina General Statute GS 133-3, this project will contain preferred brand alternates for door hardware locksets (Best), tile carpeting (Shaw), direct digital control (DDC) for HVAC (Honeywell), intelligent fire alarm detection system and integrated digital audio (Notifier), access control system (Johnson Controls), closed-circuit television (CCTV) surveillance system (Johnson Controls), and the public address system (MOOD Media). The Airport stipulates that these preferred brand alternates are necessary to provide branding and aesthetic consistency, compatibility with existing building functions and maintenance, and reduction of cost of building operations and maintenance processes.

Bid Forms, Plans, Specifications, and Contract Documents Bidding documents may be examined at the office of Mr. Granseur Dick, Wilmington International Airport, 1740 Airport Boulevard, Suite 12, Wilmington, NC 28405, between the hours of 8:00 a.m. and 5:00 p.m., and the following plan rooms' websites:

Dodge Data & Analytics – www.construction.com
Carolinas Plan Room – www.carolinasplanroom.com
iSqFt + bidclerk – www.iSqFt.com

Bidders may obtain a complete set of bidding documents beginning on Tuesday, December 4, 2018 from: McGee Cadd Reprographics, 2527 S. 17th St., Wilmington, NC 28401, (910)

392-5500, e-mail: mcgee01@mcgee-cadd.com, upon the non-refundable payment of services charges.

Each bid must be accompanied by a Bid Bond, a deposit of cash or by a certified check payable to New Hanover County Airport Authority, and drawn on some bank or trust company authorized to do business in the State of North Carolina, for an amount equal to 5% of the total base bid, as a guarantee that if the bid is accepted, the required Contract will be executed and the required Performance Bond and Payment Bond furnished within fifteen (15) days after receipt of written notice of formal award of Contract.

IMPORTANT NOTICE TO BIDDERS: Each bidder for this project shall be registered as a prequalified bidder with New Hanover County at the time of the bid opening and shall hold a North Carolina General Contractor's License. A list of pre-qualified BHS subcontracting firms is included in the bid documents to assist prime contractors.

Prospective bidders should read the instructions for preparing bids in the project specifications carefully before submitting their bids.

Envelopes containing proposals must be sealed, addressed to Mr. Granseur Dick, Planning and Development Director, Wilmington International Airport, 1740 Airport Boulevard, Suite 12, Wilmington, NC 28405, and marked on the envelope as follows:

"PROPOSAL FOR TERMINAL IMPROVEMENTS – CONTRACT 2"

SPECIAL NOTE: The New Hanover County Airport Authority, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

New Hanover County Airport Authority reserves the right to reject any and all bids, to waive informalities, and to re-advertise this solicitation at the Authority's sole discretion. Nothing herein shall be construed as a commitment on the part of the authority to award a contract. The authority reserves the right to reject all bids and abandon the solicitation at its sole discretion.

DOCUMENT 001116 - INVITATION TO BID

1.1 PROJECT INFORMATION

A. Notice to Bidders: Prequalified bidders, as indicated on the New Hanover County "Contractors Approved for Bidding" list, are invited to submit bids for Project as described in this Document according to the Instructions to Bidders.

B. Project Identification: ILM Terminal Improvements Contract 2.

1. Project Location: 1740 Airport Boulevard, Wilmington, NC 28405.

C. Owner: New Hanover County Airport Authority, 1740 Airport Boulevard, Suite 12, Wilmington, NC 28405.

1. Owner's Representative: Granseur Dick, PE, ILM Planning and Development Director

D. Architect: The Wilson Group, 2113 Commonwealth Avenue, Charlotte, NC 28205.

1. Architect's Representative: Travis Pence, AIA

E. Project Description: Project consists of furnishing all labor, materials and equipment and performing all work required to satisfactorily complete the project, which consists of phased renovation and expansion of the ticket lobby and airline offices, phased installation of new outbound baggage handling system (BHS) equipment in the Airport’s passenger terminal, and phased demolition of existing BHS equipment. The project also includes mechanical, electrical, plumbing, fire protection, structural and civil work items related to the renovation and expansion of the Ticket Lobby and the BHS installation; and provision of SIDA-badged baggage porters to assist airlines and TSA in baggage handling operations during construction.

F. Construction Contract: Bids will be received for General Contract (all trades).

1.2 BID SUBMITTAL AND OPENING

A. Owner will receive sealed bids until the bid time and date at the location indicated below. Owner will consider bids prepared in compliance with the Instructions to Bidders issued by Owner, and delivered as follows:

1. Bid Date: January 29, 2019.
2. Bid Time: 11:00 a.m., local time.
3. Location: Conference Room, Wilmington International Airport, 1740 Airport Boulevard, Wilmington, North Carolina.

B. Bids will be thereafter publicly opened and read aloud.

1.3 BID SECURITY

A. Bid security shall be submitted with each bid in the amount of 5 percent of the bid amount. No bids may be withdrawn for a period of 60 days after opening of bids. Owner reserves the right to reject any and all bids and to waive informalities and irregularities.

1.4 PREBID CONFERENCE

A. A prebid conference for all bidders will be held at Conference Room of Wilmington International Airport, 1740 Airport Boulevard, Wilmington, North Carolina on December 11, 2018 at 3:00 p.m., local time. Prospective bidders are requested to attend.

1.5 DOCUMENTS

A. Bid Forms, Plans, Specifications, and Contract Documents Bidding documents may be examined at the office of Mr. Granseur Dick, Wilmington International Airport, 1740 Airport Boulevard, Suite 12, Wilmington, NC 28405, between the hours of 8:00 a.m. and 5:00 p.m., and the following plan rooms' websites:

1. Dodge Data & Analytics – www.construction.com
2. Carolinas Plan Room – www.carolinasplanroom.com
3. iSqFt + bidclerk – www.iSqFt.com

B. Bidders may obtain a complete set of bidding documents beginning on December 4, 2018 from: McGee Cadd Reprographics, 2527 S. 17th St., Wilmington, NC 28403, (910) 799-1212, e-mail: mcgee01@mcgee-cadd.com, upon the non-refundable payment of services charges.

1.6 TIME OF COMPLETION AND LIQUIDATED DAMAGES

A. Bidders shall begin the Work on receipt of the Notice to Proceed and shall complete the Work within the Contract Time. Work is subject to liquidated damages as indicated in the Contract Documents.

1.7 BIDDER'S QUALIFICATIONS

A. Bidders must be prequalified by New Hanover County.

B. Bidders must be properly licensed under the laws governing their respective trades and be able to obtain insurance and bonds required for the Work. A Performance Bond, a separate Labor and Material Payment Bond, and Insurance in a form acceptable to Owner will be required of the successful Bidder.

END OF DOCUMENT 001116

DRAFT

AIA® Document A701™ – 1997

Instructions to Bidders

for the following PROJECT:
(Name and location or address)
ILM Terminal Improvements Contract 2

THE OWNER:
(Name, legal status and address)
New Hanover County Airport Authority
1740 Airport Boulevard
Wilmington, NC 28405

THE ARCHITECT:
(Name, legal status and address)
The Wilson Group
2113 Commonwealth Drive
Charlotte, NC 28205

TABLE OF ARTICLES

1 DEFINITIONS

2 BIDDER'S REPRESENTATIONS

3 BIDDING DOCUMENTS

4 BIDDING PROCEDURES

5 CONSIDERATION OF BIDS

6 POST-BID INFORMATION

7 PERFORMANCE BOND AND PAYMENT BOND

8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

AIA Document A701™ – 1997. Copyright © 1970, 1974, 1978, 1987 and 1997 by The American Institute of Architects. **All rights reserved.**
WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This draft was produced by AIA software at 10:51:11 on 01/11/2017 under Order No.9674553240_1 which expires on 09/23/2017, and is not for resale.
User Notes: (1296136747)

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the bid form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect prior to the execution of the Contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 The Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

AIA Document A701™ – 1997. Copyright © 1970, 1974, 1978, 1987 and 1997 by The American Institute of Architects. **All rights reserved.**
WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This draft was produced by AIA software at 10:51:11 on 01/11/2017 under Order No.9674553240_1 which expires on 09/23/2017, and is not for resale.
User Notes: (1296136747)

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

§ 3.1.3 Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them.

§ 3.3 SUBSTITUTIONS

§ 3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

§ 3.3.2 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.3 If the Architect approves a proposed substitution prior to receipt of Bids, such approval will be set forth in an Addendum. Bidders shall not rely upon approvals made in any other manner.

§ 3.3.4 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 ADDENDA

§ 3.4.1 Addenda will be transmitted to all who are known by the issuing office to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

AIA Document A701™ – 1997. Copyright © 1970, 1974, 1978, 1987 and 1997 by The American Institute of Architects. **All rights reserved.**
WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This draft was produced by AIA software at 10:51:11 on 01/11/2017 under Order No.9674553240_1 which expires on 09/23/2017, and is not for resale.
User Notes: (1296136747)

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 PREPARATION OF BIDS

§ 4.1.1 Bids shall be submitted on the forms included with the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change."

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall make no additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1 All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

§ 4.3.3 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

AIA Document A701™ – 1997. Copyright © 1970, 1974, 1978, 1987 and 1997 by The American Institute of Architects. **All rights reserved.**
WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This draft was produced by AIA software at 10:51:11 on 01/11/2017 under Order No.9674553240_1 which expires on 09/23/2017, and is not for resale.
User Notes: (1296136747)

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. The Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's own best interests.

§ 5.3.2 The Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 CONTRACTOR'S QUALIFICATION STATEMENT

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.2 OWNER'S FINANCIAL CAPABILITY

The Owner shall, at the request of the Bidder to whom award of a Contract is under consideration and no later than seven days prior to the expiration of the time for withdrawal of Bids, furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Unless such reasonable evidence is furnished, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 SUBMITTALS

§ 6.3.1 The Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, after notification of selection for the award of a Contract, furnish to the Owner through the Architect in writing:

- **.1** a designation of the Work to be performed with the Bidder's own forces;
- **.2** names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; and
- **.3** names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

AIA Document A701™ – 1997. Copyright © 1970, 1974, 1978, 1987 and 1997 by The American Institute of Architects. **All rights reserved.**
WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This draft was produced by AIA software at 10:51:11 on 01/11/2017 under Order No.9674553240_1 which expires on 09/23/2017, and is not for resale.
User Notes: (1296136747)

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder in writing if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 BOND REQUIREMENTS

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Bonds may be secured through the Bidder's usual sources.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

§ 7.2 TIME OF DELIVERY AND FORM OF BONDS

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to be commenced prior thereto in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond. Both bonds shall be written in the amount of the Contract Sum.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

AIA Document A701™ – 1997. Copyright © 1970, 1974, 1978, 1987 and 1997 by The American Institute of Architects. **All rights reserved.**
WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. This draft was produced by AIA software at 10:51:11 on 01/11/2017 under Order No.9674553240_1 which expires on 09/23/2017, and is not for resale.
User Notes: (1296136747)

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

SUPPLEMENTARY INSTRUCTIONS TO BIDDERS, GENERAL

The following supplements modify AIA Document A701 - 1997 Instructions to Bidders. Where a portion of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, unaltered portions of Instructions to Bidders shall remain in effect.

ARTICLE 2 BIDDER'S REPRESENTATIONS

*Add **§2.1.3.1**:*

§2.1.3.1 The Bidder has investigated all required fees, permits, and regulatory requirements of authorities having jurisdiction and has properly included the cost of such fees, permits, and requirements not otherwise specifically indicated as provided by the Owner, in the submitted bid.

*Add **§2.1.5**:*

§2.1.5 The Bidder is properly licensed Contractor in accordance with the General Statutes of the State of North Carolina and meets qualifications indicated in the Bidding Documents.

ARTICLE 3 BIDDING DOCUMENTS

§3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

*Add **§3.2.2.1**:*

§3.2.2.1 Submit requests for interpretation of the bidding documents in writing using "Bidder's Request For Information Form".

§3.3 SUBSTITUTIONS

*Add **§3.3.2.1**:*

§3.3.2.1 Submit substitution requests in writing using "Bidder's Request For Substitution," properly completed and signed. The Architect will review requests for substitution of comparable products when submitted by Prime Bidders. Submit requests to the Architect no later than 10 days prior to the date established for receipt of bids. Attach a copy of the respective specification section with point-by-point compliance or variance, and accompanied by sufficient independently certified test data, code and third party approvals, product samples, and additional information needed to support the request. Architect's acceptance of products on previous projects does not guarantee acceptance on this Project. Undocumented requests will not be reviewed. Approval of requests is by Addendum only.

§3.4 ADDENDA

*Delete **§3.4.3** and replace with the following:*

§3.4.3 Addenda may be issued at any time prior to the receipt of bids.

*Add **§3.4.4.1**:*

§3.4.4.1 The Owner may elect to waive the requirement for acknowledgement of received Addenda in §3.4.4 if:

.1 Information received as part of the bid indicates that the bid as submitted reflects modifications to the Bidding Documents included in an unacknowledged Addendum, or

.2 Modifications to the Bidding Documents in an unacknowledged Addendum do not, in the opinion of the Owner, affect the Contract Sum or Contract Time.

ARTICLE 4 BIDDING PROCEDURES

§4.1 PREPARATION OF BIDS

*Add **§4.1.8**:*

§4.1.8 The Bid shall include Unit Prices when called for by the Bidding Documents. The Owner may elect to consider Unit Prices in the determination of award. Unit Prices accepted by the Owner will be incorporated in the Contract.

*Add **§4.1.9**:*

§4.1.9 The Owner may elect to disqualify a bid due to failure to submit a bid in the form requested, failure to bid requested Alternates or Unit Prices, failure to complete entries in all blanks in the Bid Form, or inclusion by the Bidder of any alternates, conditions, limitations or provisions not called for.

*Add **§4.1.10**:*

§4.1.10 Bids shall include sales and use taxes. Contractors shall show separately with each monthly payment application the sales and use taxes paid by them and their subcontractors in the form indicated. Reimbursement of sales and use taxes, if any, shall be applied for by the Owner for the sole benefit of the Owner.

*Add **§4.1.11**:*

§4.1.11 Each Bid shall be accompanied by listing of Minority Businesses that will be utilized on the project and affidavit documenting good faith efforts to encourage and facilitate minority participation in the project.

§4.1.11.1 A Minority person, for purposes of this Contract, is a citizen or lawful permanent resident of the United States who is Black, Hispanic, Asian-American, American Indian or female.

§4.1.11.2 A Minority Business, for purposes of this Contract, is a business in which at least fifty-one percent (51%) is owned by one or more minority persons, or in the case of a corporation, in which at least fifty-one percent (51%) of the stock is owned by one or more minority person and of which the management and daily business operations are controlled by one or more of the minority person who own it.

§4.3 SUBMISSION OF BIDS

*Add **§4.3.1.1 and §4.3.1.2**:*

§4.3.1.1 Use Bid Form provided in project manual to submit bid.

§4.3.1.2 Include Bidder's State of North Carolina Contractor License Number on the face of the sealed bid envelope.

§4.4 MODIFICATION OR WITHDRAWAL OF BIDS

*Add the following to **§4.4.2**:*

§4.4.2.1 Such modifications to or withdrawal of a Bid may only be made by persons authorized to act on behalf of the Bidder. Authorized persons are those so identified in the Bidder's corporate by-laws, specifically empowered by the Bidder's charter or similar legally binding document acceptable to the Owner, or by a power of attorney, signed and dated, describing the scope and limitations of the power of attorney. Make such documentation available to the Owner at the time of seeking modifications or withdrawal of Bid.

§4.4.2.2 The Owner will consider modifications to a Bid written on the sealed bid envelope by authorized persons when such modifications comply with the following: the modification is indicated by a percent or stated amount to be added to or deducted from the Bid; the amount of the Bid itself is not made known by the modification; a signature of the authorized person, along with the time and date of the modification, accompanies the modification. Completion of an unsealed bid form, awaiting final figures from the Bidder, does not require power of attorney due to the evidenced authorization of the Bidder implied by the circumstance of the completion and delivery of the Bid.

*Add **§4.5**:*

§4.5 SUBCONTRACTORS, SUPPLIERS, AND MANUFACTURERS LIST BID SUPPLEMENT

§4.5.1 Provide a list of major subcontractors, suppliers, and manufacturers furnishing or installing products no later than 2 business days following Architect's request. Include those entities providing work totaling 3 percent or more of the bid amount. Do not change subcontractors, suppliers, and manufacturers from those submitted without approval of Architect.

ARTICLE 5 CONSIDERATION OF BIDS

§5.2 REJECTION OF BIDS

*Add **§5.2.1**:*

§5.2.1 The Owner reserves the right to reject a Bid based upon the Owner's and Architect's evaluation of qualification information submitted following opening of bids. The Owner's evaluation of the Bidder's qualifications will include: status of licensure and record of compliance with licensing requirements, record of quality of completed work, record of project completion and ability to complete, record of financial management including financial resources available to complete the Project and record of timely payment of obligations, record of project site management including compliance with requirements of authorities having jurisdiction, record of and number of current claims and disputes and the status of their resolution, and qualifications of the Bidder's proposed project staff and proposed subcontractors.

ARTICLE 6 POST-BID INFORMATION

§6.1 CONTRACTOR'S QUALIFICATION STATEMENT

*Add **§6.1.1**:*

§6.1.1 Submit Contractor's Qualification Statement no later than 2 business days following Architect's request.

§6.3 SUBMITTALS

*Add **§6.3.1.4**:*

§6.3.1.4 Submit information requested in **§6.3.1.1, §6.3.1.2,** and **§6.3.1.3** no later than 2 business days following Architect's request.

*Add **§6.3.5**:*

§6.3.5 Apparent lowest bidder shall provide a completed Baggage Handling System (BHS) Price Schedule and Baggage Handling System (BHS) Unit Pricing Schedule no later than 2 business days following bid opening. BHS Price Schedule total shall match BHS Turn Key provided on Bid Form. An electronic version of BHS Price Schedule and Unit Pricing will be provided by Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§7.1 BOND REQUIREMENTS

*Add **§7.1.1.1**:*

§7.1.1.1 Both a Performance Bond and a Payment Bond will be required, each in an amount equal to one hundred percent of the Contract Sum.

§7.2 TIME OF DELIVERY AND FORM OF BONDS

*Delete the first sentence of **§7.2.1** and insert the following:*

The Bidder shall deliver the required bonds to the Owner not later than 10 days after the date of the notice to award and not later than the date of execution of the Contract, whichever occurs first. The Owner may deem the failure of the Bidder to deliver required bonds within the period of time allowed a default.

*Delete **§7.2.3** and insert the following:*

§7.2.3 Bonds shall be executed and be in force on the date of the execution of the Contract.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

*Add **§8.1**:*

§8.1 EXECUTION OF THE CONTRACT

§8.1.1 Subsequent to the notice to award, and within 10 days after the prescribed Form of Agreement is presented to the Awardee for signature, the Awardee shall execute and deliver the Agreement to the Owner through the Architect, in such number of counterparts as the Owner may require.

§8.1.2 The Owner may deem the failure of the Awardee to execute the Contract and to supply the required bonds when the Agreement is presented for signature within the period of time allowed a default.

§8.1.3 Unless otherwise indicated in the Bidding Documents or the executed Agreement, the date of commencement of the Work shall be the date of the executed Agreement or the date that the Bidder is obligated to deliver the executed Agreement and required bonds to the Owner.

§8.1.4 In the event of a default, the Owner may declare the amount of the bid security forfeited and elect to either award the Contract to the next responsible bidder or re-advertise for bids.

*Add **§8.2**:*

§8.2 TIME OF COMMENCEMENT AND COMPLETION

§8.2.1 The Contractor shall commence Work within 10 days following execution of the Contract, or when notified in writing to proceed, and shall complete the Work within the Contract Time.

END OF SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

Wilmington International Airport (ILM)
Terminal Renovations & Expansion Contract 2
Baggage Handling System (BHS) Price Schedule
INSERT VENDOR NAME HERE

ITEM NO.	SUPPLIES/SERVICES (per CSI Specification Division)	LF / QTY.	UNIT	UNIT PRICE	AMOUNT
	Division 34 - Section 347739 - Baggage Conveying Equipment (All unit pricing below to include design, engineering, installation, demolition/removal, labor, materials, tools, equipment, controls, phasing and all administrative requirements as called for in the specification.)				
1.01	**SUBSYSTEM: TC1**				**$0.00**
	Furnish & Install Outbound Ticket Counter Collection Conveyors with Stainless Steel Shrouding		LF	$ -	$0.00
	Furnish & Install Outbound Standard Run-out Conveyors with Shrouding		LF	$ -	$0.00
	Furnish & Install Outbound Standard Transport Conveyors		LF	$ -	$0.00
	Furnish & Install Outbound 90-degree Power Turn with Stainless Steel Shrouding		EA	$ -	$0.00
	Furnish & Install 90-degree Standard Power Turns		EA	$ -	$0.00
	Furnish & Install Fire/Security Door		EA	$ -	$0.00
1.02	**SUBSYSTEM: TC2**				**$0.00**
	Furnish & Install Outbound Ticket Counter Collection Conveyors with Stainless Steel Shrouding		LF	$ -	$0.00
	Furnish & Install Outbound Standard Transport Conveyors		LF	$ -	$0.00
	Furnish & Install Outbound 90-degree Power Turn with Stainless Steel Shrouding		EA	$ -	$0.00
	Furnish & Install Metering/Queuing Conveyor		EA	$ -	$0.00
	Furnish & Install 45-degree Standard Power Turn		EA	$ -	$0.00
	Furnish & Install 45-degree Merge Conveyor		EA	$ -	$0.00
	Furnish & Install Fire/Security Door		EA	$ -	$0.00
1.03	**SUBSYSTEM: OT1**				**$0.00**
	Furnish & Install Outbound Standard Transport Conveyors		LF	$ -	$0.00
	Furnish & Install Outbound Standard Input/Load Conveyors with Shrouding		LF	$ -	$0.00
	Furnish & Install 90-degree Standard Spiral Power Turn		EA	$ -	$0.00
1.04	**SUBSYSTEM: OS1**				**$0.00**
	Furnish & Install Oversize Slide		EA	$ -	$0.00
	Furnish & Install Fire/Security Door		EA	$ -	$0.00
1.05	**SUBSYSTEM: MU1**				**$0.00**
	Furnish & Install Outbound Incline Plate Device		LF	$ -	$0.00
	SUBTOTAL - INSTALLATION (Items 1.01 to 1.05 inclusive)				**$0.00**
1.06	Existing BHS Conveyor Equipment Demo/Removal & Disposal		LS	$ -	$0.00
1.07	Interim Condition Input Ticketing Conveyor		LF	$ -	$0.00
1.08	Interim Condition 180-degree Power Turn		EA	$ -	$0.00
1.09	PC-Type Computer Workstation (Fault Diagnostics, Reporting, & HMI)		LS	$ -	$0.00
1.10	BHS Maintenance Catwalk (with sheet steel), & Associated Ships Ladders, Swing-down Aluminum Ladders, Vertical Fixed Ladders, & Cross-overs		LS	$ -	$0.00
1.11	Portering/Manual Handling of Baggage during interim BHS		LS	$ -	$0.00
1.12	Mechanical Installation		LS	$ -	$0.00
1.13	Electrical Installation		LS	$ -	$0.00
1.14	Engineering		LS	$ -	$0.00

Wilmington International Airport (ILM)
Terminal Renovations & Expansion Contract 2
Baggage Handling System (BHS) Price Schedule
INSERT VENDOR NAME HERE

ITEM NO.	SUPPLIES/SERVICES (per CSI Specification Division)	LF / QTY.	UNIT	UNIT PRICE	AMOUNT
1.15	Program Management		LS	$ -	$0.00
1.16	Testing and Commissioning		LS	$ -	$0.00
1.17	Shipping		LS	$ -	$0.00
1.18	Insurance		LS	$ -	$0.00
1.19	Bonds		LS	$ -	$0.00
1.20	O&M Manuals		LS	$ -	$0.00
1.21	Training		LS	$ -	$0.00
1.22	Warranty Service		LS	$ -	$0.00
1.23	Other (list)		LS	$ -	$0.00
1.24	1. P.E. Stamp		LS	$ -	$0.00
1.25	Taxes		LS	$ -	$0.00
1.26	Allowance For BHS Spare Parts	1	LS	$ 100,000.00	$100,000.00
	SUBTOTAL MISC. - (Items 1.06 to 1.26 inclusive)				**$100,000.00**
	TOTAL TURNKEY PRICE (Items 1.01 to 1.26 inclusive)				**$100,000.00**
1.27	**BHS Bid Alternate:** Furnish & Install BHS Maintenance Catwalk (with open steel grating), & Associated Ships Ladders, Swing-down Aluminum Ladders, Vertical Fixed Ladders, & Cross-overs		LS	$ -	$0.00

NOTES:

Wilmington International Airport (ILM)
Terminal Renovations & Expansion Contract 2
Baggage Handling System (BHS) Unit Pricing
INSERT VENDOR NAME HERE

UNIT PRICING

ITEM NO.	SUPPLIES/SERVICES	LF / QTY.	UNIT	UNIT PRICE	AMOUNT
UNIT PRICE SUMMARY TABULATION (BASED ON QUANTITIES AS INSTALLED CONDITIONS)					
	New Ticketing Load Belt Conveyor				
2.01	0-15 feet		LF	$ -	$0.00
2.02	16-40 feet		LF	$ -	$0.00
2.03	41-70 feet		LF	$ -	$0.00
	New Standard Conveyor				
2.04	0-15 feet		LF	$ -	$0.00
2.05	16-40 feet		LF	$ -	$0.00
2.06	41-70 feet		LF	$ -	$0.00
	Maintenance Catwalks				
2.07	BHS Catwalks with open steel grating option		SF	$ -	$0.00
2.08	BHS Catwalks with sheet steel		SF	$ -	$0.00
2.09	Maintenance Catwalk Ships Ladder		Unit	$ -	$0.00
2.10	Maintenance Catwalk Swing-down Aluminum Ladder		Unit	$ -	$0.00
2.11	Maintenance Catwalk Vertical Fixed Ladder		Unit	$ -	$0.00
2.12	Maintenance Catwalk Cross-over (over standard conveyor)		Unit	$ -	$0.00
2.13	Maintenance Catwalk Cross-overs (over make-up device)		Unit	$ -	$0.00
	New Power Turns				
2.14	45^0 Power Turn		Unit	$ -	$0.00
2.15	90^0 Power Turn		Unit	$ -	$0.00
2.16	Other Power Turn Angles (indicate angle)		Unit	$ -	$0.00
2.17	New Fire/Security Doors		Unit	$ -	$0.00
2.18	New 45^0 Merge Conveyor		Unit	$ -	$0.00
2.19	New Metering/Queue Conveyor		Unit	$ -	$0.00
	New Oversize Equipment				
2.20	Oversize Chute		Unit	$ -	$0.00

BIDDER'S REQUEST FOR INFORMATION FORM

Project: ILM Terminal Improvements Contract 2

The Wilson Group Project # 9202-000

To: The Wilson Group
2113 Commonwealth Ave
Charlotte, NC 28205

E-Mail: travis@twgarchitects.com
Attn: Travis Pence, AIA

Requested By: _____
Firm: _____
Phone No.: _____
Date: _____
Related Section and Paragraph No.: _____
Related Drawings/Details: _____

Bidder's Inquiry:

Signed:

Response:

Architect's response will be issued by formal Addendum.

Signed: Date:

BIDDER'S REQUEST FOR SUBSTITUTION FORM

Requests for Substitution are accepted from prime bidders only. Subcontractors and suppliers must submit requests through a prime bidder. Bidders are required to submit this completed form with required attachments no later than 10 days prior to opening of bids. Comply with requirements of the Instructions to Bidders and Supplementary Instructions to Bidders.

Project:	ILM Terminal Improvements Contract 2	Project No.:	9202-000
To:	The Wilson Group	Specification Section #:	
	Charlotte, NC	Prime Bidder:	
Attn.:	Travis Pence	Requested by:	
Phone:	704-331-9747	Phone:	
Fax:	704-331-9748	Fax:	
Email:	travis@twgarchitects.com	Email:	

Specified Product/Fabrication Method
(List name/description; model no.; manufacturer):

Required Information for ***Specified*** Product:	Attached:
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Fabrication Drawings	☐
Samples (Where Applicable)	☐

Proposed Product/Fabrication Method
(List trade name/description; model no.; manufacturer) :

Required Information for ***Proposed*** Product:	Attached:
Point by Point Comparative Product Data	☐ (Required)
Tests	☐
Reports	☐
Fabrication Drawings	☐
Samples (Where Applicable)	☐

List of Related Changes/Modifications:

Differences between proposed substitution and specified product:

Proposed product/fabrication method affects other parts of the Work ☐ No ☐ Yes: Explain _____

_____

_____

Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product as utilized for this project, except as noted herein.
- Qualifications of manufacturer, installer, and other specified parties meet the specified qualifications.
- Same special warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source for replacement parts, as applicable, is available as that specified.
- Proposed substitution does not affect dimensions and functional clearances, except as noted herein.

For the Bidder:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

Fax: _____

Email: _____

For the Manufacturer:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

Fax: _____

Email: _____

END OF BIDDER'S REQUEST FOR SUBSTITUTION FORM

BID FORM

Project Name: ILM Terminal Improvements Contract 2
Project Location: Wilmington, North Carolina

1.1 BID INFORMATION

A. Date: _____

B. Bidder: _____

C. Bidder's Contractor License Number: _____

D. Owner: New Hanover County Airport Authority

E. Architect: The Wilson Group

F. Architect Project Number: 9202-000

1.2 CERTIFICATIONS AND BASE BID

A. Base Bid, Single-Prime (All Trades) Contract: The undersigned Bidder, having carefully examined the Procurement and Contracting Requirements, Conditions of the Contract, Drawings, Specifications, and all subsequent Addenda, as prepared by The Wilson Group, LS3P and Architect's consultants, having visited the site, and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all material, labor, equipment and services, including all scheduled/indicated allowances, necessary to complete the construction of the above-named project, according to the requirements of the Procurement and Contracting Documents, for the stipulated sum of:

1. _____
_____ Dollars ($_____).

1.3 BID GUARANTEE

A. The undersigned Bidder agrees to execute a contract for this Work in the above amount and to furnish surety as specified within 10 days after a written Notice of Award, if offered within 60 days after receipt of bids, and on failure to do so agrees to forfeit to Owner the attached cash, cashier's check, certified check, U.S. money order, or bid bond, as liquidated damages for such failure, in the following amount constituting five percent (5%) of the Base Bid amount above:

1. _____ Dollars ($_____).

B. In the event Owner does not offer Notice of Award within the time limits stated above, Owner will return to the undersigned the cash, cashier's check, certified check, U.S. money order, or bid bond.

1.4 SUBCONTRACTORS

A. The following companies shall execute subcontracts for the portions of the Work indicated:

		Name	License Number
1.	Plumbing Work:	_____	_____
2.	HVAC Work:	_____	_____
3.	Electrical Work:	_____	_____

4. Baggage Handling: _____

5. Baggage Control System Subcontractor: _____

B. The General Contractor shall act as Project Expediter.

1.5 ALLOWANCES

The undersigned Bidder acknowledges that Allowances, as specified in Section 012100 and modifying addenda, are included in their General Construction Work Base Bid.

1.6 UNIT PRICES

A. Unit prices quoted and accepted shall apply throughout the life of the contract, except as specifically noted. Unit prices shall be applied, as appropriate, to compute the total value of changes in the scope of the work in accordance with the contract documents.

Unit Price No. 1 - Unsuitable Soil - Engineered Fill:

1. Description: Unsuitable soil removal and disposal and placement and compaction of new satisfactory fill.
2. Cost per Cubic Yard: $ _____

Unit Price No. 2 - Unsuitable Soil - No. 57 Stone:

1. Description: Unsuitable soil removal and disposal and placement and compaction of No. 57 stone.
2. Cost per Cubic Yard: $ _____

1.7 ALTERNATES

A. The undersigned proposes to perform alternatives for stated resulting additions to or deductions from the Base Bid. Additions and deductions shall include any modifications of work or additional work that undersigned may be required to perform by reason of the acceptance of any alternative. (Bidder shall write in the amounts for the alternates listed below.)

Alternate No. 1: Open Steel Grating Catwalks

Adjust Base Bid by Adding _____

_____ Dollars ($ _____)

Alternate No. 2: Locksets by Best

Adjust Base Bid by Adding _____

_____ Dollars ($ _____)

Alternate No. 3: Carpet Tile by Shaw

Adjust Base Bid by Adding _____

_____ Dollars ($ _____)

Alternate No. 4: Direct Digital Control BAS by Honeywell

Adjust Base Bid by Adding _____

_____ Dollars ($ _____)

Alternate No. 5: Closed-Circuit Television (CCTV) Surveillance System by Johnson Controls

Adjust Base Bid by Adding _____

_____ Dollars ($ _____)

Alternate No. 6: Public Address System by MOOD Media

Adjust Base Bid by Adding _____

_____ Dollars ($ _____)

Alternate No. 7: Access Control by Johnson Controls

Adjust Base Bid by Adding _____

_____ Dollars ($ _____)

Alternate No. 8: Intelligent Fire Alarm Detection System and Integrated Digital Audio by Notifier

Adjust Base Bid by Adding _____

_____ Dollars ($ _____)

1.8 HUB-M/WBE PARTICIPATION REQUIREMENTS

(Historically Underutilized Businesses - Minority/Women-Owned Business Enterprise)

Provide on the bid - Under GS 143-128 the undersigned bidder shall identify on its bid the minority businesses that it will use on the project and the total dollar value of the bid that will be performed by the minority businesses and list the good faith efforts made to solicit participation.

Note: Bidders must submit with their bid the *Report of Participating Subcontractors and Suppliers, Certification of Competitive Bids, M/WBE Subcontractor Contact Schedule, and Good Faith Efforts Affidavit.*

1.9 TIME OF COMPLETION

A. The undersigned Bidder proposes and agrees hereby to commence the Work of the Contract Documents on a date specified in a written Notice to Proceed to be issued by Architect, and shall fully complete the Work within and not exceed the time limits set forth in the Contract Document.

B. The undersigned Bidder acknowledges that 'Liquidated Damages' provisions shall be in effect for this project as stated in the Contract Document.

1.10 ACKNOWLEDGEMENT OF ADDENDA

A. The undersigned Bidder acknowledges receipt of and use of the following Addenda in the preparation of this Bid:

1. Addendum No. I, Dated _____.
2. Addendum No. II, Dated _____.
3. Addendum No. III, Dated _____.
4. Addendum No. IV, Dated _____.
5. Addendum No. V, Dated _____.

1.11 CONTRACTOR'S LICENSE

A. The undersigned further states that it is a duly licensed contractor, for the type of work proposed, in the State of North Carolina, and that all fees, permits, etc., pursuant to submitting this proposal have been paid in full.

1.12 SUBMISSION OF BID

A. Respectfully submitted this _____ day of _____, 20_____.

B. Submitted By: _____
(Name of Bidding Firm or Corporation)

C. Authorized Signature: _____
(Handwritten Signature)

D. Signed By: _____
(Type or Print Name)

E. Title: _____
(Owner/Partner/President/Vice President)

F. Witness/Attest: _____
(Handwritten Signature)

G. Signed By: _____
(Type or Print Name)

H. Title: _____
(Corporate Secretary or Assistant Secretary)

I. Street Address: _____

J. City, State, Zip: _____

K. Phone: _____

L. E-Mail: _____

M. License No.: _____

N. Federal ID No.:_____ (Affix Corporate Seal Here)

END OF BID FORM

NEW HANOVER COUNTY
FINANCE DEPARTMENT

LISA WURTZBACHER
Finance Director

BARBARA D. MCCLURE
Assistant Finance Director

IMPORTANT NOTICE TO BIDDERS

The following documents must be submitted along with the bid proposal. Responses of "doing the work with your own forces" are unacceptable. Failure to submit required documents may result in your bid being considered non-responsive.

NAME OF DOCUMENT	PAGE NUMBER
REPORT OF PARTICIPATING SUBCONTRACTORS & SUPPLIERS	MBE/EEO-3
CERTIFICATION OF COMPETITIVE BIDS	MBE/EEO-4
M/WBE SUBCONTRACTOR CONTACT SCHEDULE	MBE/EEO-5
GOOD FAITH EFFORTS AFFIDAVIT	MBE/EEO-6

BID CONDITIONS

MINORITY/WOMEN BUSINESS ENTERPRISE PROGRAM

The following bid conditions apply to this contract. Submission of a bid/proposal by a prospective contractor shall constitute full acceptance of these bid conditions.

1. **Definition.** Minority/Women Business Enterprise (M/WBE) is a business that is at least 51% owned and controlled by a minority, woman or socially and economically disadvantaged persons.

2. **Policy.** It is the policy of New Hanover County that minority businesses, as defined by N.C.G.S. 143-128 have maximum opportunity to participate in the performance of contracts and subcontracts funded in whole or in part with public funds. Consequently, the New Hanover County M/WBE requirements apply to this contract.

3. **M/WBE Obligation.** The contractor agrees to ensure that minority business enterprises have maximum opportunity to participate in the performance of contracts or subcontracts financed in whole or in part with County funds. In this regard, all contractors shall take all necessary and reasonable steps to ensure that minority business enterprises have maximum opportunity to compete for and perform contracts/subcontracts. Contractors shall not discriminate on the basis of race, color, national origin, or sex, in the award and performance of County contracts.

4. **Compliance.** All bidders, potential contractors, or subcontractors for this contract are hereby notified that failure to carry out the County policy and the M/WBE obligation, as set forth above, shall constitute a breach of contract which may result in termination of the contract or such other remedy as deemed appropriate by the owner.

5. **Contract Award.** Bidders are hereby advised that meeting the M/WBE subcontract goals or making an acceptable good faith effort to meet such goals, are conditions of being awarded this contract. The owner proposes to award the contract to the lowest responsive and responsible bidder submitting a reasonable bid, provided s/he has made an acceptable good faith effort to meet the goals for M/WBE participation.

   Bidders are advised that the owner has sole authority to determine if the bidders have made sufficient effort toward meeting M/WBE goals to qualify for contract award. The owner reserves the right to reject any or all bids submitted.

6. **Subcontract Goals.** The attainment of goals established for this contract is to be measured as a percentage of the total dollar value of the contract. The goals established for this contract are as follows:

M/WBE*	10 Percent

*M/WBE goals are accomplished via subcontracts performed by certified minority, woman, and socially and economically disadvantaged business owners.

7. **Available M/WBEs.** Bidders should utilize M/WBE's certified by the NC Department of Administration. To locate certified firms, visit the Department of Administration at http://www.doa.state.nc.us/hub/searchhub.htm.

   In addition to M/WBE firms certified by the NC Department of Administration, firms certified as DBE, WBE or MBE by the NC Department of Transportation (NCDOT) may be utilized toward the participation goal. The NCDOT DBE/MBE/WBE database can be found at https://www.ebs.nc.gov/VendorDirectory/default.html.

8. **Contractor's Required Submission.** The following information concerning M/WBE participation in the contract **must be submitted along with the bid proposal**. Failure to submit required information will result in the bidder's proposal being considered non-responsive.

REPORT OF PARTICIPATING SUBCONTRACTORS	(PAGE MBE/EEO-4)
CERTIFICATION OF COMPETITIVE BIDS	(PAGE MBE/EEO-5)
M/WBE CONTACT SCHEDULE	(PAGE MBE/EEO-6)
GOOD FAITH EFFORTS AFFIDAVIT	(PAGE MBE/EEO-7)

   Bidders must submit **along with the bid proposal**, information stated above, in order to assist the owner in determining whether s/he made acceptable good faith efforts to meet the established contract goal. Failure to meet the goal by lack of good faith efforts will disqualify the bidder's proposal.

9. **Good Faith Efforts**. An affidavit which includes a list of the efforts that a contractor can make and the owner may use in making a determination as to the acceptableness of a contractor's efforts to meet the goals is attached. The affidavit must be completed, fully executed, notarized, and submitted **along with the bid proposal**. ***A minimum of five areas must be checked in order to have achieved a "good faith effort".***

   Agreements between bidder/proposer and an M/WBE in which the M/WBE promises not to provide subcontracting quotations to other bidders/proposers are prohibited. The bidder shall make a good faith effort to replace an M/WBE

subcontractor that is unable to perform successfully, with another M/WBE subcontractor. Substitution must be coordinated and approved by the owner.

The bidder shall establish and maintain records and submit regular reports, as required, which will identify and assess progress in achieving M/WBE subcontract goals and other M/WBE affirmative action efforts.

REPORT OF PARTICIPATING SUBCONTRACTORS & SUPPLIERS

Please supply data for all subcontractors and suppliers, whose services will be utilized on the project being bid upon by your firm. **This document must be completed and submitted along with the bid proposal.**

BIDDER'S NAME:_____ PROJECT:_____

AMOUNT OF BID: $_____ VALUE OF SUBCONTRACTS: $_____

SUBCONTRACTORS & SUPPLIERS

(1)
Name of Firm: _____ ☐ MBE ☐ WBE ☐ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
☐ SUBCONTRACTOR ☐ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

(2)
Name of Firm: _____ ☐ MBE ☐ WBE ☐ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
☐ SUBCONTRACTOR ☐ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

(3)
Name of Firm: _____ ☐ MBE ☐ WBE ☐ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
☐ SUBCONTRACTOR ☐ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

(4)
Name of Firm: _____ ☐ MBE ☐ WBE ☐ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
☐ SUBCONTRACTOR ☐ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

(5)
Name of Firm: _____ ☐ MBE ☐ WBE ☐ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
☐ SUBCONTRACTOR ☐ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

Total MBE $:_____(%) Total WBE $:_____(%) Total Other $:_____(%)

SUBCONTRACTORS & SUPPLIERS (CONTINUED)

(6)
Name of Firm: _____ □ MBE □ WBE □ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
□ SUBCONTRACTOR □ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

(7)
Name of Firm: _____ □ MBE □ WBE □ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
□ SUBCONTRACTOR □ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

(8)
Name of Firm: _____ □ MBE □ WBE □ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
□ SUBCONTRACTOR □ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

(9)
Name of Firm: _____ □ MBE □ WBE □ OTHER
Address: _____ Phone: _____
Owner's Name(s): _____
□ SUBCONTRACTOR □ SUPPLIER
Work/Service To Be Performed:_____
Project Commitment Date:_____ Completion Date:_____
Amount To Be Paid: $_____ % Of Total Contract: _____%

Total MBE $:_____(%) Total WBE $:_____(%) Total Other $:_____(%)

The undersigned will enter formal agreements with subcontractors or suppliers named in this document, if awarded a contract by Owner. Failure to do so, may constitute a breach of contract.

DATE:_____ BIDDER'S SIGNATURE: _____

PRINT NAME: _____

TITLE: _____

NEW HANOVER COUNTY

FINANCE OFFICE
230 GOVERNMENT CENTER DRIVE,
SUITE 165
WILMINGTON, NORTH CAROLINA 28403
TELEPHONE (910) 798-7187
FAX (910) 798-7806
www.nhcgov.com

CERTIFICATION OF COMPETITIVE BIDS

RE: Project: _____

Bid Amount: $_____

Dear Sir or Madam:

My signature below certifies that my firm, _____, has solicited a minimum of three (3) bids from prospective minority/women business subcontractors and/or suppliers on the above-referenced project.

Signed: _____ Date: _____

Print Name: _____ Title: _____

NEW HANOVER COUNTY MBE
SUBCONTRACTOR CONTACT SCHEDULE

Prime Contractor: Project: Bid Date:

Date Contacted	Person Making Contact	Name & Address of MBE/WBE Firm	Phone Number of MBE/WBE Firm	Person Contacted	Work Item To Be Performed	Response of MBE/WBE Firm	Price Quote

I hereby certify that the subcontractors listed above were contacted by my firm, and requested to submit quotes on the above-referenced project.
All interested subcontractors were negotiated with in good faith.

Signed: Title:

Print Name: Phone Number:

GOOD FAITH EFFORT AFFIDAVIT

This document must be completed and ***submitted along with the bid proposal***. A minimum of five (5) areas must be checked in order to have achieved a "good faith effort."

County of New Hanover

Affidavit of_____
(Name of Bidder)

[ ] (1) Contacting MBE/WBE/DBE businesses available on the NC Department of Administration website and/or the NCDOT website at least 10 days before the bid or proposal date and notifying them of the nature and scope of the work to be performed.

[ ] (2) Making the construction plans, specifications and requirements available for review by prospective minority businesses, or providing these documents to them at least 10 days before the bid or proposals are due.

[ ] (3) Breaking down or combining elements of work into economically feasible units to facilitate minority participation.

[ ] (4) Working with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that pride assistance in recruitment of minority businesses.

[ ] (5) Attending any prebid meetings scheduled by the public owner.

[ ] (6) Providing assistance in getting required bonding or insurance or providing alternatives to bonding or insurance for subcontractors.

[ ] (7) Negotiating in good faith with interested minority businesses and not rejecting them as unqualified without sound reasons based on their capabilities. Any rejection of a minority business based on lack of qualification should have the reasons documented in writing.

[ ] (8) Providing assistance to an otherwise qualified minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisting minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.

[ ] (9) Negotiating joint venture and partnership arrangements with minority businesses in order to increase opportunities for minority business participation on a public construction or repair project when possible.

[ ] (10) Providing quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

In accordance with N.C.G.S. 143-128.2(d) the undersigned will enter into a formal agreement with the firms listed in the Subcontractor/Supplier Participation Schedule, conditioned upon execution of a contract with the Owner. Failure to abide by this statutory provision will constitute a breach of the contract.

The undersigned hereby certifies that s/he has read the conditions of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____ Name of Authorized Officer:_____
_____

Date:_____ Name of Authorized Officer:_____

Signature:_____Title:_____

State of North Carolina, County of_____ SEAL

Subscribed and affirmed to before me this ____day of _____20___

Notary Public_____ My Commission Expires:_____

DOCUMENT 003132 - PROJECT INFORMATION

PART 1 - GENERAL

1.1 DOCUMENT INCLUDES

A. Information that is made available to Bidders is for reference only, and is not intended to be part of the Contract.

1. Geotechnical Engineering Report
2. Report of Pavement and Subsurface Investigation
3. Report of Subsurface Investigation Duct Bank Near Outbound Baggage
4. Report of SUE Results
5. Airline Schedule

1.2 USE OF INFORMATION PROVIDED

A. Bidders are encouraged to review available Project information prior to submitting a Bid, and to obtain additional information if Bidder desires.

B. Owner-furnished information is provided only for information and convenience to Bidders. The Owner, Architect, or Architect's consultants do not warrant accuracy, adequacy, or applicability of information contained in available Project information. Owner and Architect disclaim responsibility for accuracy of information that has been prepared by others. Owner and Architect further disclaim responsibility for interpretation of that information by Bidders. The information and recommendations in available Project information are the sole responsibility of the preparer.

1.3 PROJECT INFORMATION

A. This Document, with its referenced attachment, is part of the Procurement and Contracting Requirements for Project. They provide information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' other investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions.

1. This Document and its attachment are for information only and are not part of the Contract Documents.
2. Immediately on discovery of a difference between the Geotechnical Data and the Contract Documents, prepare and submit a detailed report to the Architect and Owner.

B. A Geotechnical Engineering Report, prepared by Stewart, dated April 11, 2018, is attached to this Document.

C. A Report of Pavement and Subsurface Investigation for Project, prepared by GeoTechnologies, Inc, dated April 10, 2018, is attached to this Document.

D. A Report of Subsurface Investigation Duct Bank Near Outbound Baggage, prepared by GeoTechnologies, Inc. dated May 23, 2018, is attached to this Document.

E. A Report of SUE Results, prepared by LowCountry Locating LLC, is attached to this Document.

F. Airline Schedule, provided by Wilmington International Airport, dated July, 2018, is attached to this Document.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 003132

STEWART

STRONGER BY DESIGN

GEOTECHNICAL ENGINEERING REPORT

Wilmington International Airport
Terminal Expansion
Wilmington, North Carolina

April 11, 2018

GEOTECHNICAL ENGINEERING REPORT

Wilmington International Airport Terminal Expansion
Wilmington, North Carolina

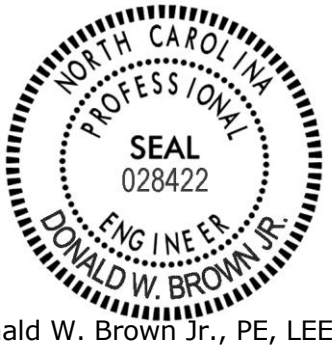
April 11, 2018

Prepared For:
THE WILSON GROUP
PO Box 5510
Charlotte, NC 28299

Prepared By:
STEWART
5400 Old Poole Road
Raleigh, NC 27610

Stewart Project No.: G18011.00

Authored by:



Donald W. Brown Jr., PE, LEED AP
Manager of Construction Services
NC PE License No. 28422

Reviewed by:

Chien-Ting Tang, EI, Ph.D
Geotechnical Project Engineer

Stewart License No. C-1051

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY 1

2 PROJECT INFORMATION 2
2.1 Project Understanding 2
2.2 Site Location and Description 2
2.3 Geologic Area Overview 2

3 SUBSURFACE EXPLORATION 3
3.1 Field Testing 3
3.2 Subsurface Conditions 3
3.2.1 Ground Cover 3
3.2.2 Soils 3
3.2.3 Groundwater 3

4 ENGINEERING ASSESSMENT AND RECOMMENDATIONS 5
4.1 Site Development 5
4.1.1 Site Preparation 5
4.1.2 Groundwater 5
4.2 Fill Selection and Compaction 5
4.3 Foundations 6
4.3.1 Design 6
4.3.2 Construction 6
4.4 Slab-On-Grade 7
4.4.1 Design 7
4.4.2 Construction 7
4.5 Seismic Design Considerations 8

Appendix A
Site Vicinity Map
Test Location Diagram
Appendix B
CPT Logs
Appendix C
Shear wave velocity profile
Preliminary Liquefaction Analysis
Appendix D
Site Photographs

1 EXECUTIVE SUMMARY

Stewart has completed a geotechnical exploration for the proposed terminal expansion at Wilmington International Airport in Wilmington, North Carolina. This Executive Summary is provided as a brief overview of our geotechnical engineering evaluation for the project and is not intended to replace more detailed information contained elsewhere in this report. A summary of our findings, opinions, and recommendations is provided below.

- The current plans include a renovation/remodeling of the current ramp and ticketing levels, as well as 13,600± square feet of new construction to these areas.

- A total of eight cone penetration tests (CPT) were performed to approximate depths ranging from 34 feet to 51 feet below the existing grade.

- The subsurface conditions encountered by the CPTs have primary soil behavior type of sands with interbedded layers of silt and clay.

- Groundwater depths range from approximately 7 to 9 feet below the existing ground surface.

- The soils encountered are not susceptible to liquefaction for the design earthquake event.

- The site meets the requirements of a Seismic Site Class D according to the 2012 NC State Building Code.

- Based on the soil conditions encountered and the estimated building loads, we recommend the use of conventional spread footings and a slab-on-grade for the expansion.

The owner/designer/contractor should not rely solely upon the summary above. This report should be read in its entirety prior to implementing the recommendations in the preparation of design and construction documents. Stewart should be retained to perform sufficient services to determine plan/specification compliance with the recommendations in this report.

2 PROJECT INFORMATION

2.1 Project Understanding

The terminal expansion will be two levels tall to match the existing structure. The lower "ramp" level will house baggage circulation while the upper "ticketing" level will accommodate passenger check-ins, offices and other airline services. The project will include both remodeling of the existing space and 13,600± SF of new construction.

The building will be steel framed with a concrete slab-on-grade. Typical service loads range from 20 kips to 140 kips; however, portions of the structure have additional wind and seismic demands up to 120 kips. For the purpose of this report, we have assumed a maximum column load of 175 kips.

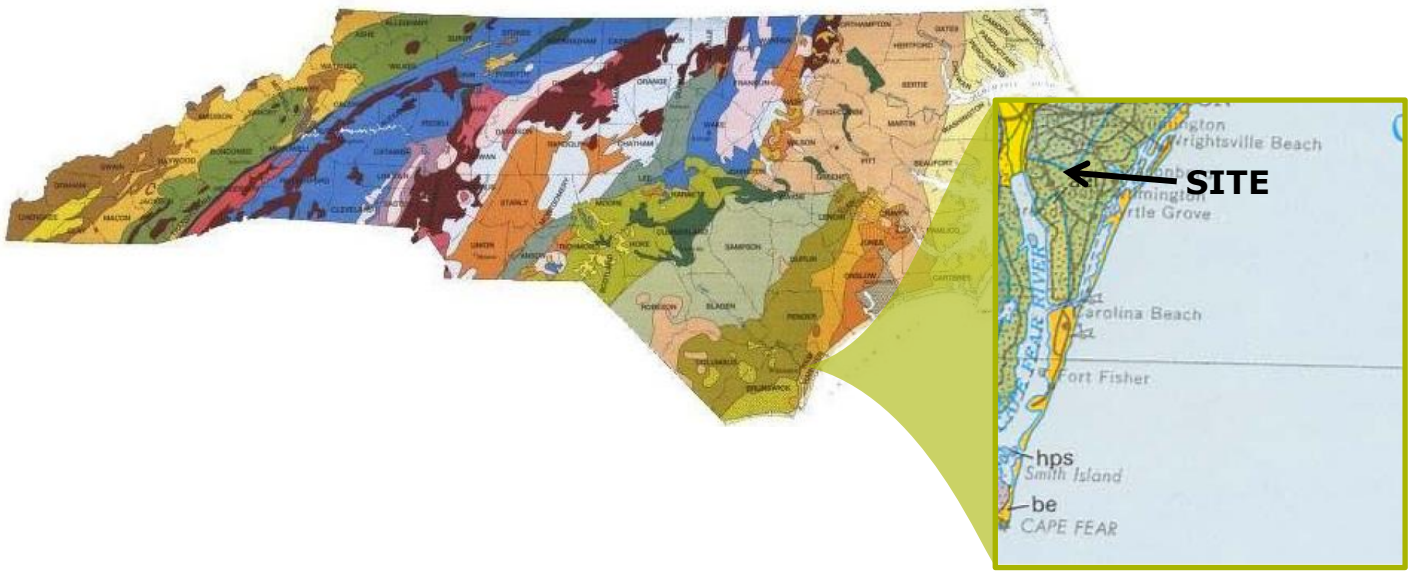
2.2 Site Location and Description

The airport is located at 1740 Airport Boulevard in Wilmington, NC. The expansion site is developed and paved with concrete (apron), which is generally flat. See the 2016 aerial map obtained from New Hanover County's GIS website in Appendix A for the site location and current conditions.

2.3 Geologic Area Overview

The site lies within the Coastal Plain Geologic Province of the eastern United States. Review of the *Quaternary Geologic Map of the Hatteras 4º x 6º Quadrangle United States* (G.H Johnson and P.C. Pebbles, 1986) indicates that the soil below the site is characterized indistinctly bedded silty clay and quartz sand (mld) of the Peedee Formation, which was deposited in the Middle Pleistocene epoch. The soil deposits in this area sometimes includes gravelly sand and fossils.

According to the *Interpretive Geologic Map of Basement Rocks Beneath the North Carolina Coastal Plain* (D.P. Lawrence and C.W. Hoffman, 1993), the basement rock in this area is approximately 1,200 feet below mean sea level and consists of hornblende biotite gneiss. Also of note, the same map indicates that an ancient inferred thrust fault is located in close proximity to the site (within 10,000± feet). This fault is considered to be inactive.



3 SUBSURFACE EXPLORATION

3.1 Field Testing

The subsurface exploration for this project involved a total of eight Cone Penetration Tests (CPT) as illustrated on the Test Location Diagram in Appendix A. CPT is a continuous testing method by which a cone-tipped apparatus is advanced into the ground with slender rods using a hydraulic press. The testing procedures are governed by ASTM D5778. The cone tip is comprised of a 60-degree angled tip with an area of 10 cm^2 and a cylindrical sleeve with a surface area of 150 cm^2 with internal load transducers. As the penetrometer is pushed into the ground, resistance readings for the tip resistance (qt) and sleeve friction (fs) are taken every 2 inches and transmitted back to a laptop computer via cabling. Dynamic pore water pressures (u) are also recorded during the advancement process. This suite of data is used to evaluate the soil stiffness/strength and is the basis of the design recommendations herein.

All CPTs were advanced to cone refusal at depths ranging from approximately 34 feet to 51 feet below the current ground surface. While onsite, shear wave velocity (SWV) testing was performed with seismic cone penetration tests (SCPT) at CPT-4 and CPT-7. This testing uses a velocity seismometer housed in the cone and ground vibrations created by striking both ends of the CPT rig's jack beam with an instrumented sledge hammer. The arrival times for the shear waves generated by the hammer strike are recorded and analyzed relative to the vertical and horizontal distances to the seismometer. This data is used to determine the velocity at which shear waves can travel through the subgrade soils and allows for a more representative seismic site classification as provided later in this report.

3.2 Subsurface Conditions

3.2.1 Ground Cover

The subject site is covered by concrete paving. The pavement was cored at each location to allow CPT, with concrete thicknesses varying from 17 inches to 24 inches.

3.2.2 Soils

The following subsurface description is of a generalized nature. With the CPT process, no soil samples are collected for viewing/classification or laboratory testing. Rather, the soil types and stratification thereof are plotted based on Soil Behavior Types (SBT) developed by Robertson, et al (1990). The SBT is a correlation between common soil types and resistance factors (qc and fs) and is generalized based on the key soil constituent(s) (i.e. sand, silt, or clay).

The soil profile primarily consists of sand with relatively thin layers of interbedded silts and clays. However, a thicker silt/clay stratum was encountered across the site at approximately 21 feet below grade and varies in thickness from approximately 4 feet to 8 feet thick.

Based on our past experience in this area, the refusal material is likely dense cemented sands of a layer of limestone.

3.2.3 Groundwater

Pore water pressure readings were recorded during the advancement of the CPT probe to estimate the depth of the water table. Depth of groundwater immediately after withdrawing the CPT probe was also

measured in the open probe hole, where able. Based on these measurements, the groundwater ranges in depth from approximately 7 feet to 9 feet below the current grade.

The groundwater conditions represent the conditions at the time of the exploration. Fluctuations in groundwater levels are common and should be expected. Common factors that influence groundwater levels include, but are not limited to, soil stratification, climate/weather, nearby bodies of water (lakes, ponds, etc.), underground springs, streams, tidal movement, rivers and surface water discharge. At the onset, as well as continually throughout the construction process, the contractor should monitor groundwater levels if determined to be detrimental to the project. Management of groundwater can significantly impact construction procedures/practices, schedules and project budgets.

4 ENGINEERING ASSESSMENT AND RECOMMENDATIONS

4.1 Site Development

4.1.1 Site Preparation

Initially, all remnants of pavement demolition, pavement, and any other unsatisfactory or deleterious materials should be removed from the proposed areas scheduled for site development for a lateral distance of at least 3 feet beyond the limits of new construction. Decommissioned utilities should be removed and replaced with compacted soil.

After removal of the concrete pavement, the exposed subgrade should be scarified, moisture conditions (if needed) , and compacted as described in Section 4.2 of this report. Areas of the site to receive new fill or directly support new construction should be proofrolled with a tandem-axle dump truck weighing between 15 and 20 tons. Proofrolling should occur prior to fill placement or after reaching final grade in cut areas in the presence of the owner's testing agency so that recommendations can be provided for areas that rut, pump, or deflect excessively. Proofrolling should not be performed on frozen or excessively wet subgrades.

4.1.2 Groundwater

Given the nature of the proposed construction, we do not anticipate deep excavations for building construction. As such, management of groundwater should be minimal. However, if site utilities require excavations depth than 7 feet, groundwater should be anticipated and the contractor should be prepared to dewater as necessary.

4.2 Fill Selection and Compaction

Any material utilized as structural fill should not contain rocks greater than 3 inches in diameter or greater than 30% retained on the ¾-inch sieve. Structural fill should possess a Maximum Dry Density (MDD) of 95 pounds per cubic foot (pcf) or greater as determined by the Standard Proctor Compaction Test (ASTM D698). We recommend that the Plasticity Index (PI) for structural fill soil be less than 20 and the Liquid Limit (LL) less than 40, as determined by Atterberg Limit testing (ASTM D4318). The onsite sands.

The water content of structural fill containing more than 5% fines should be maintained within ±3% of the material's optimum water content as determined by the Standard Proctor Compaction Test (ASTM D698). Granular soils containing less than 5% fines are considered insensitive to compaction moisture and can be placed in a wetter condition. Local placement practices include saturating or "flooding" lifts of sand and compacting after the added water has drained. This practice is suitable provided that the lift thicknesses are controlled as described below and minimum compaction requirements are met.

When using large/heavy, ride-on compactors, granular fill should be placed in loose lifts up to 10 inches thick. Lift thicknesses for granular soil should be reduced to 6 inches when using smaller/lighter, Rammax-type compactors and no more than 4 inches thick for sled and jumping-jack tampers. Rollers should be equipped with smooth drums for the granular soils common to this area. Structural fill should be compacted to 95% of the soil's maximum dry density as determined by ASTM D698. If relative density (D_r) is used as a means to determine the compaction of clean, granular material, we recommend compacting the sand to 70% (ASTM D4253/D4254).

Caution should be exercised with using vibratory compaction equipment at this site. The relatively shallow groundwater depth could result in upward migration of water during vibration, which will lead to softening/weakening of surficial soils. To minimize this potential, static rolling is recommended; however, compaction by experienced equipment operators and close oversight by an engineering technician from the owner's testing agency could enable the use of limited vibratory compaction effort.

4.3 Foundations

4.3.1 Design

Following the implementation of the site preparation recommendations discussed in Section 4.1 and 4.2 of this report, the use of conventional spread footings is considered appropriate for the proposed structure. In designing the foundation, we recommend the design parameters provided in the Table 1.

Table 1: Foundation Design Parameters

Parameter	Value
Net Allowable Bearing Capacity, psf	2,000
Minimum Bearing Depth, in.	24
Minimum Wall Footing Width, in.	18
Minimum Column Footing Width, in.	36
Estimated Post-Construction Settlement, in. Total [1] Differential	 ¾ or less ¼ or less
Moist Soil Unit Weight, pcf	120
Passive Earth Pressure Coefficient [2]	3.25
Ultimate Friction Factor (tan δ)	0.40

1. *The total settlement will be differential to the existing construction since its primary settlement is complete. Measures to accommodate this settlement at the new-old construction interface should be incorporated into the design.*
2. *We recommend that a safety factor of at least 1.5 be used to determine the soil's allowable passive resistance and the soil's allowable friction.*

4.3.2 Construction

It is preferable for spread footing excavations to be performed using a bucket with a flat cutting edge (no teeth) to reduce disturbance of the exposed bearing soil. Regardless, footing bottoms should be lightly tamped with a jumping-jack or sled compactor prior to the foundation inspection and placement of reinforcing steel. Footings should be clean of loose material and debris and protected from disturbance. This includes protection from surface water run-off and freezing. If water is allowed to accumulate within a footing excavation and soften the bearing soils, or if the bearing soils are allowed to freeze, the deficient soils should be removed from the excavation and rechecked by the Owner's testing agency prior to concrete placement. When concrete cannot be placed immediately, we recommend placing a mud-mat to protect the bearing soil.

Foundation bearing materials should be checked by the Owner's testing agency during construction to verify satisfactory bearing conditions (i.e. materials and strength). We recommend that qualified personnel use a ½-inch diameter, T-handled probe rod for an overall qualitative assessment

throughout the foundation excavations, followed by strategically-placed hand auger borings and Dynamic Cone Penetrometer (DCP) testing for quantitative evaluation. Such testing should be performed in accordance with ASTM STP-399 and completed prior to stone, steel, or concrete placement. Unsuitable soil detected during this evaluation should be repaired as directed by the testing agency.

4.4 Slab-On-Grade

4.4.1 Design

Based on the site preparation recommendations discussed in the earlier sections of this report a grade-supported slab will be suitable. In designing the slab, we recommend a minimum 6-inch base layer of washed No. 57 stone or free-draining sand (5% or less fines) to provide uniform support and to provide a capillary break. We also recommend the installation of a vapor barrier as a measure of protection against water vapor intrusion. Given the relatively shallow nature of the groundwater at this site, omitting the vapor barrier could lead to water vapor transmission through the slab and cause damage flooring and/or cause elevated moisture levels within the structure. We recommend considering the use of a vapor barrier meeting ASTM E1745, which should be installed per the ACI guidelines (ACI 302.2R) and ASTM E1643.

The design of the concrete slab-on-grade should be based on Westergaard's modulus of subgrade reaction (k). Based on the soil conditions encountered at the site, we recommend the effective k-values (k_{ef}) below for slab design. However, if the floor slab will be heavily loaded or the design is otherwise sensitive to k, we recommend performing plate load testing in accordance with ASTM D1196 to allow site-specific refinement of the design k-value.

Table 2: Slab-on-grade Design k-Values

Base Material	k_{ef} (pci)
Free draining sand	90
#57 washed stone	110

It is important to point out that cracking of concrete is normal and should be expected. Proper jointing of slabs is paramount in the control of cracking. The American Concrete Institute (ACI) recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions. Controlling the water-cement ratio of the concrete, particularly after batching, and including fiber reinforcement in the mix can also help reduce shrinkage cracking.

4.4.2 Construction

Once exposed, the slab support soils should be evaluated by the owner's testing agency to identify any weak or unstable areas that require repair prior to placement of the stone base. This is typically accomplished by proofrolling with heavy, rubber-tired equipment such as a tandem-axle dump truck. In confined areas that cannot be proofrolled with a dump truck, use of smaller rubber tire equipment, probing, and/or DCP testing should be considered.

4.5 Seismic Design Considerations

Per the 2012 N.C. State Building Code, the design of a structure must consider dynamic forces resulting from seismic events, regardless of their likelihood of occurrence. As part of a generalized procedure to estimate seismic forces, the code assigns a Seismic Site Classification (letter designation of Class A through F) based on the interpreted subgrade soil/rock conditions within the upper 100 feet of the ground surface at the subject site.

As previously mentioned in this report, shear wave velocity (SWV) testing was performed at CPT-4 and CPT-7. This testing was performed from the ground surface to their respective termination depths of 51 feet and 34 feet, at approximate 1-meter intervals. The average SWV at CPT-4 was 695 feet per second (fps) and the average SWV at CPT-7 was 802 fps. Based on this data, we recommend a seismic site class D for this site.

The following bulleted items briefly discuss our qualitative assessments of the other seismic-related issues. Detailed quantitative analyses for these items were not included in our Scope of Work and are not considered necessary at this time given the development plans and the subsurface conditions encountered.

Liquefaction Hazard – Risk level is low – Our evaluation was conducted using the Modified Robertson Method and LiquefyPro V5.5 computer software, which has determined that the subgrade soils to the depths explored are not susceptible liquefaction during the design seismic event (M=7.3, PGA = 0.0779). Total post-event settlement on the order of ¼-inch is expected based on the Ishihara & Yoshimine Procedure.

- Slope Stability – Risk level is low - Based on the grading plan, neither tall nor overly steep cut/fill slopes are planned for construction.

- Surface Rupture – Risk is low – No active faults underlie the site.

APPENDIX A

SITE VICINITY MAP
TEST LOCATION DIAGRAM



©2018: All documents including computer files and drawings prepared by Stewart are instruments of professional service intended for one-time use. They are subject to copyright and other property right laws and shall remain the property of Stewart. They are not to be copied, modified, or changed in any manner whatsoever nor assigned to a third party without prior written permission of Stewart.

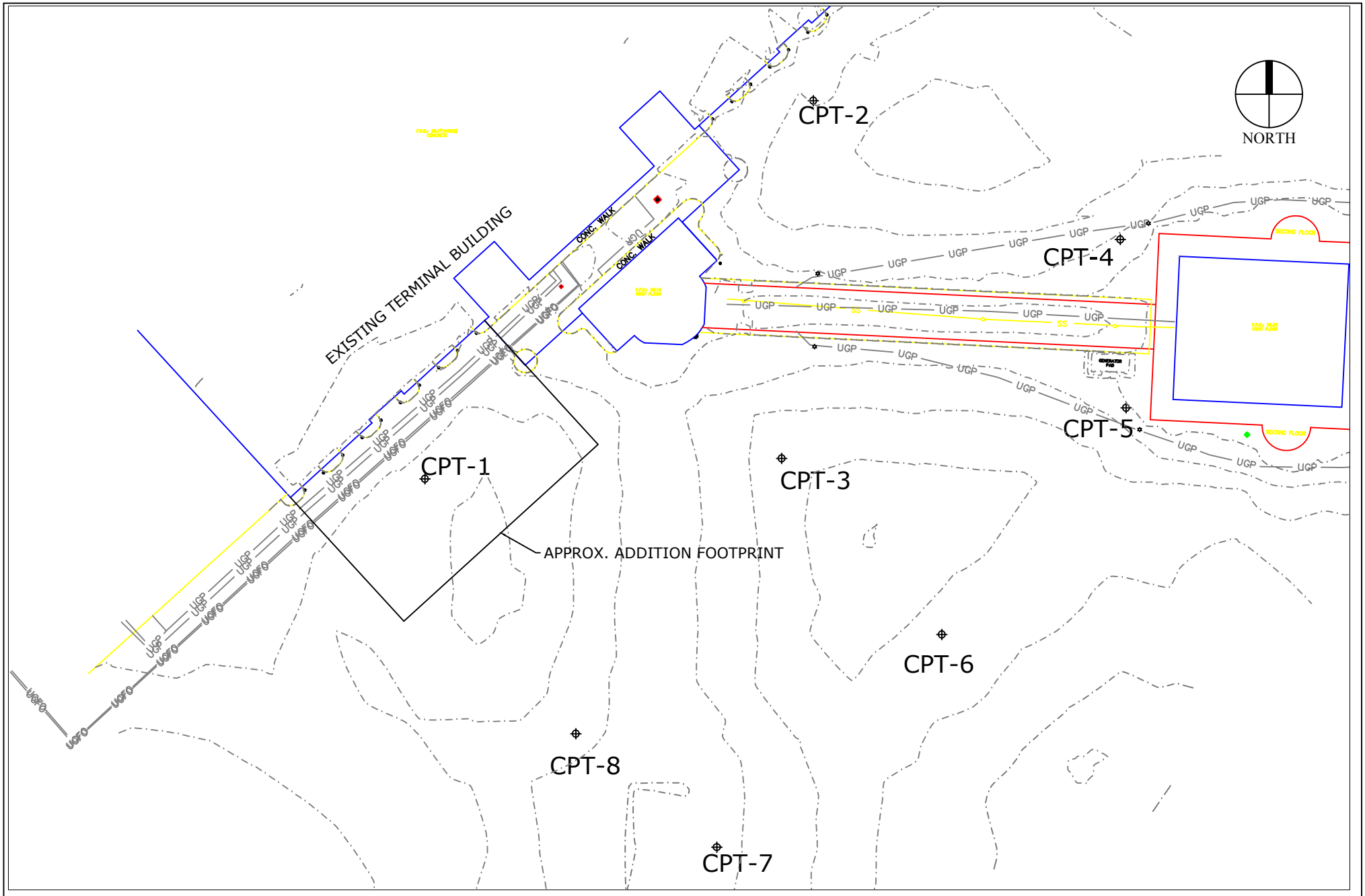
Note: All test locations are approximate (unless otherwise reported) and intended for illustration purposes only.

STEWART
5400 OLD POOLE RD
RALEIGH, NC 27610
T 919.380.8750
FIRM LICENSE #: C-1051
www.stewartinc.com

SITE VICINITY MAP
ILM TERMINAL EXPANSION
1740 Airport Blvd
Wilmington, NC

Project No.:	G18011.00
Scale:	NTS
Prepared by:	DB
Date:	April 2018

Figure No.: A1



©2018: All documents including computer files and drawings prepared by Stewart are instruments of professional service intended for one-time use. They are subject to copyright and other property right laws and shall remain the property of Stewart. They are not to be copied, modified, or changed in any manner whatsoever nor assigned to a third party without prior written permission of Stewart.

Note: All test locations are approximate (unless otherwise reported) and intended for illustration purposes only.

STEWART
5400 OLD POOLE RD
RALEIGH, NC 27610
T 918.380.8750
FIRM LICENSE #: C-1051
www.stewartinc.com

TEST LOCATION DIAGRAM
ILM TERMINAL EXPANSION
1740 Airport Blvd
Wilmington, NC

Project No.:G18011.00	Figure No.:
Scale: 1 inch = 60 ft	A2
Prepared by: DB	
Date: April 2018	

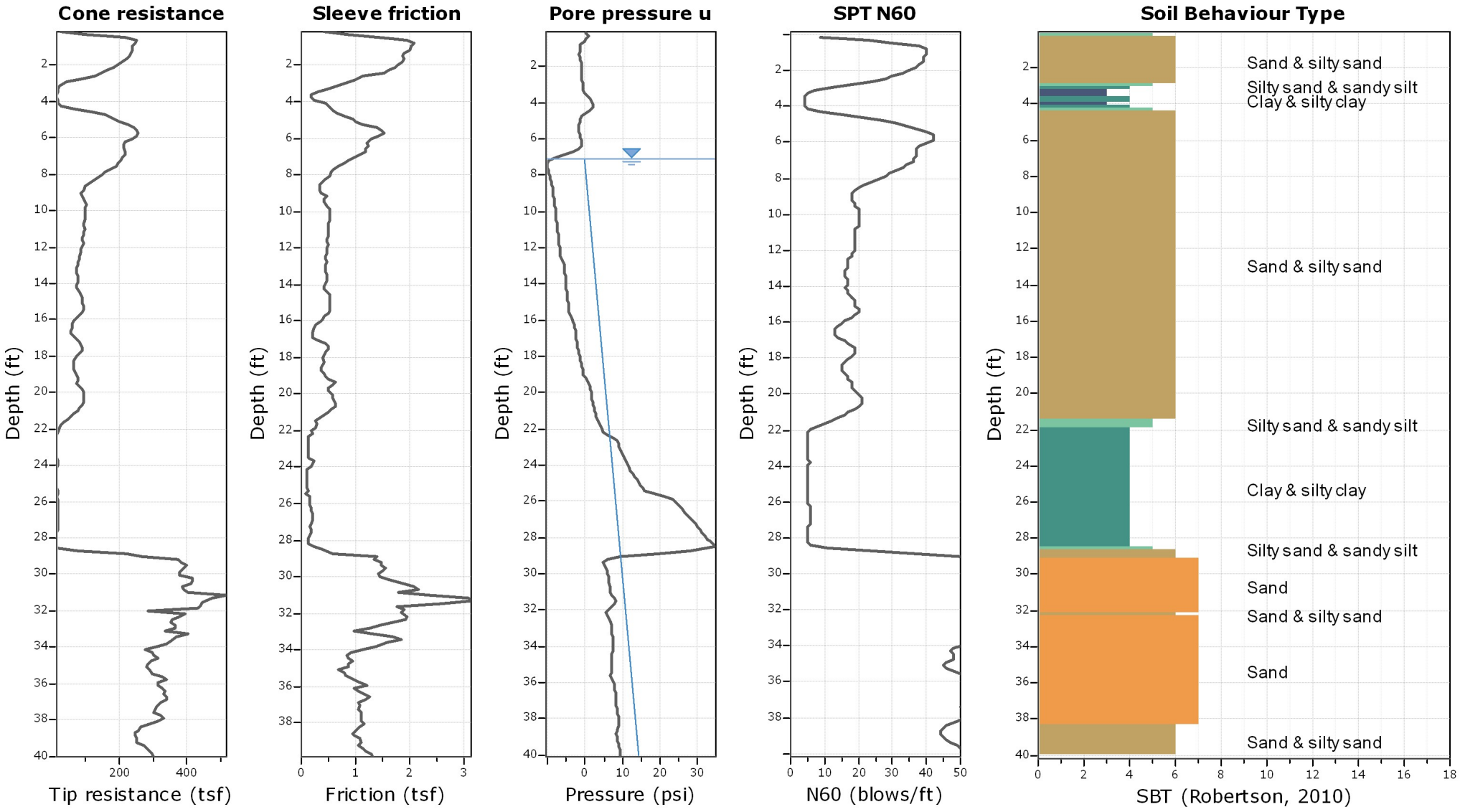
APPENDIX B

CPT LOGS

STEWART

Project: ILM Terminal Expansion
Location: Wilmington, NC

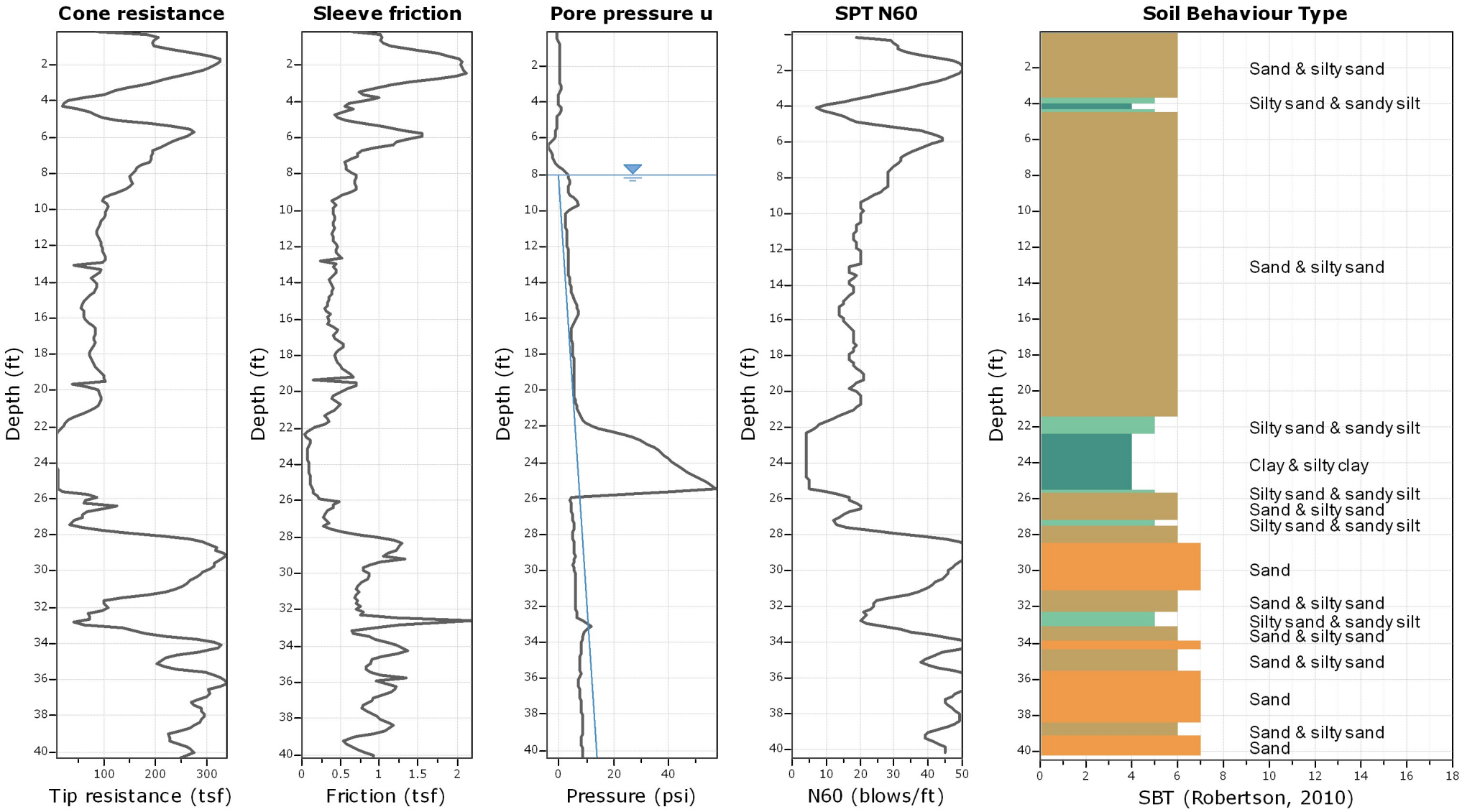
CPT: CPT-1
Total depth: 40.03 ft, Date: 2/13/2018
Surface Elevation: 27.40 ft
Cone Type: Hogentogler 10T
Cone Operator: Mid-Atlantic Drilling



STEWART

Project: **ILM Terminal Expansion**
Location: **Wilmington, NC**

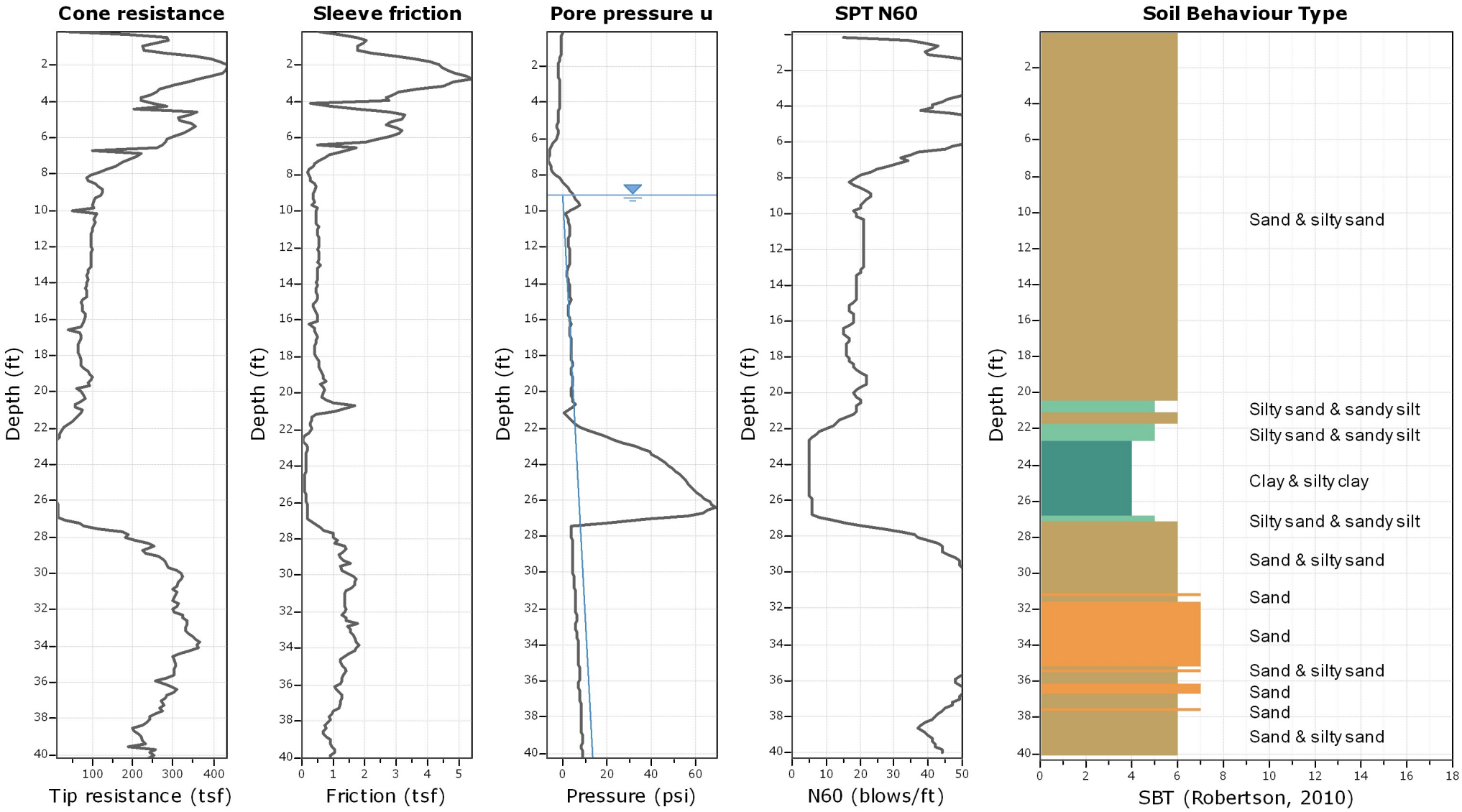
CPT: CPT-2
Total depth: 40.35 ft, Date: 2/12/2018
Surface Elevation: 27.50 ft
Cone Type: Hogentogler 10T
Cone Operator: Mid-Atlantic Drilling



STEWART

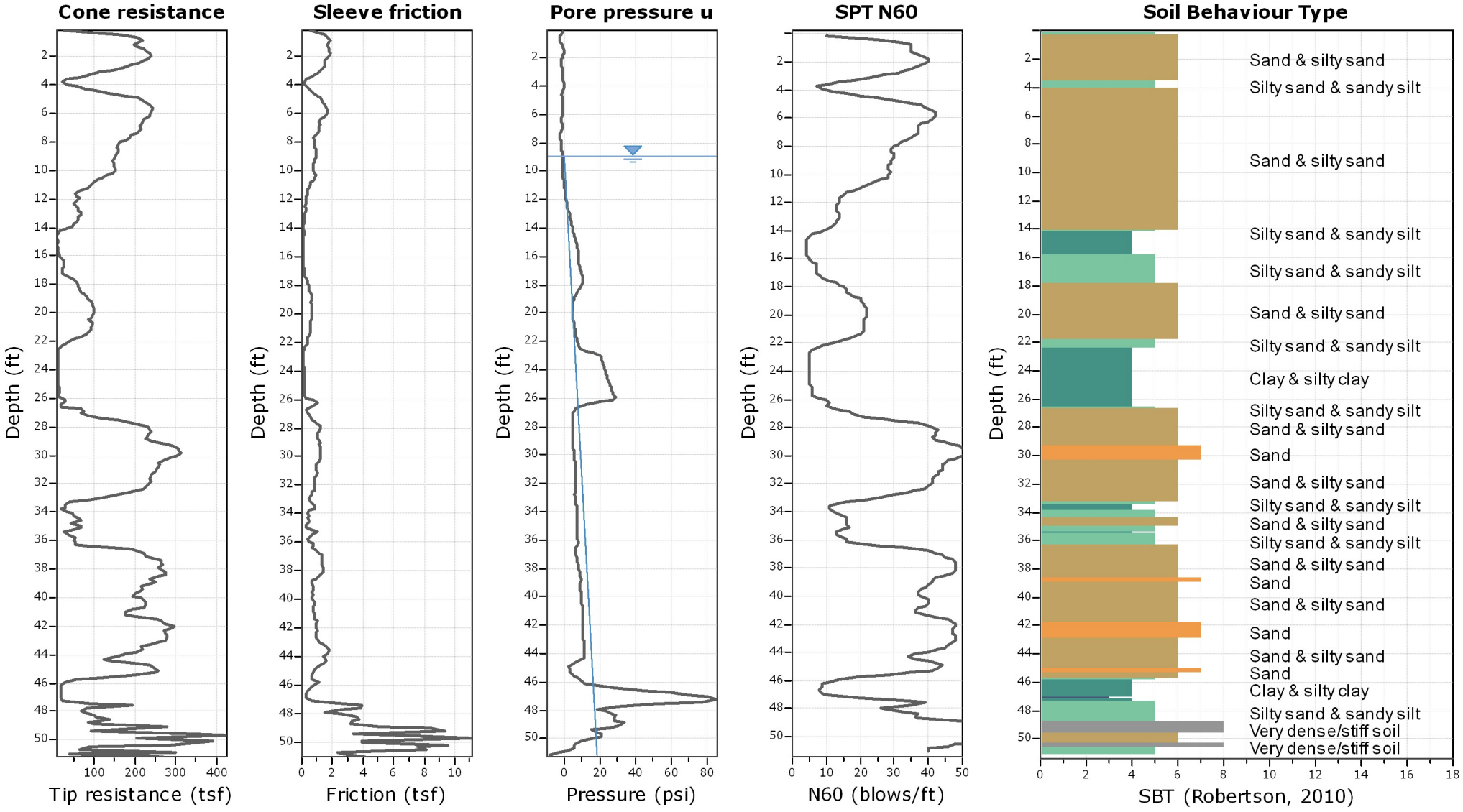
Project: **ILM Terminal Expansion**
Location: **Wilmington, NC**

CPT: CPT-3
Total depth: 40.19 ft, Date: 2/13/2018
Surface Elevation: 27.40 ft
Cone Type: Hogentogler 10T
Cone Operator: Mid-Atlantic Drilling



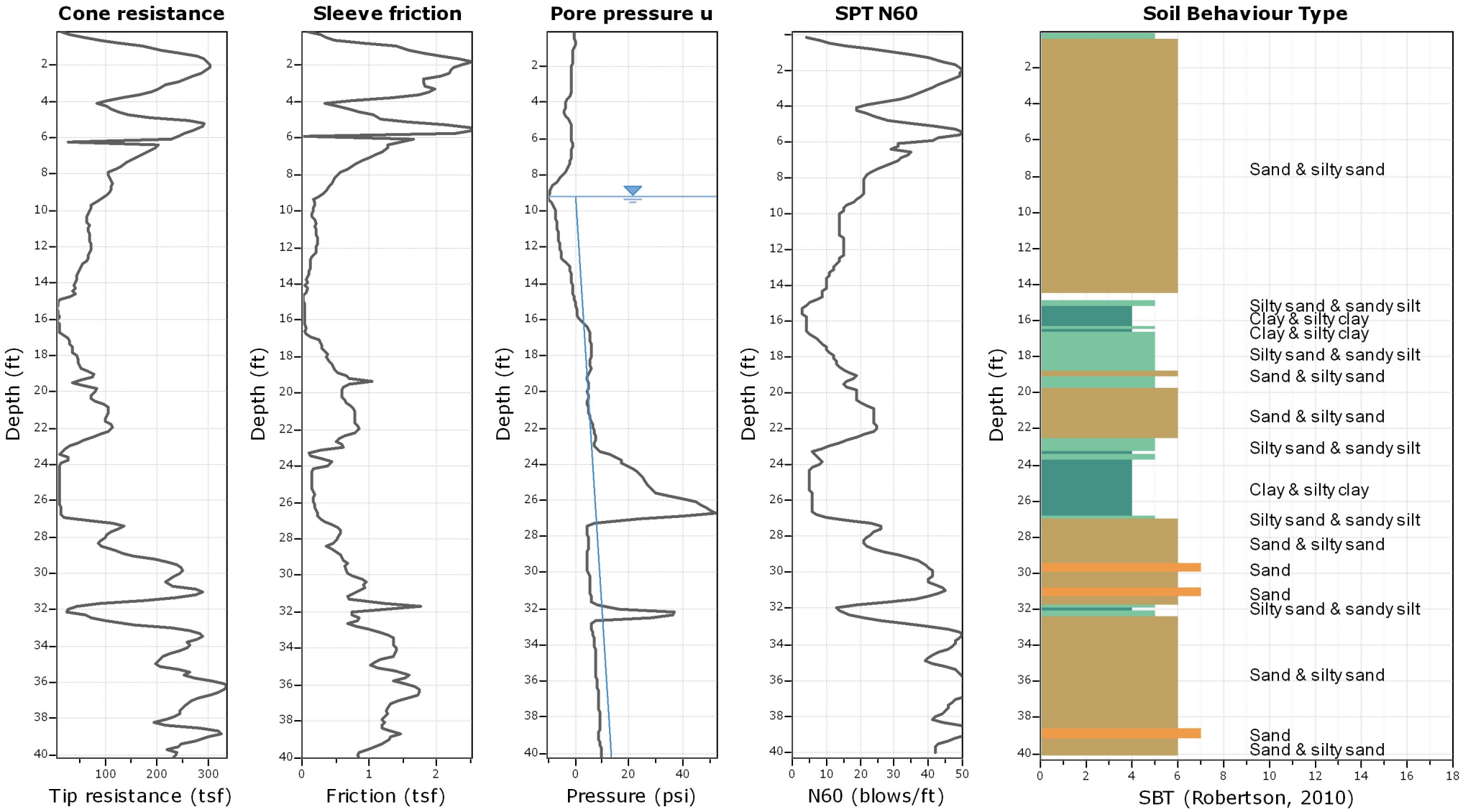
Project: ILM Terminal Expansion
Location: Wilmington, NC

CPT: CPT-4
Total depth: 51.18 ft, Date: 2/13/2018
Surface Elevation: 27.80 ft
Cone Type: Hogentogler 10T
Cone Operator: Mid-Atlantic Drilling



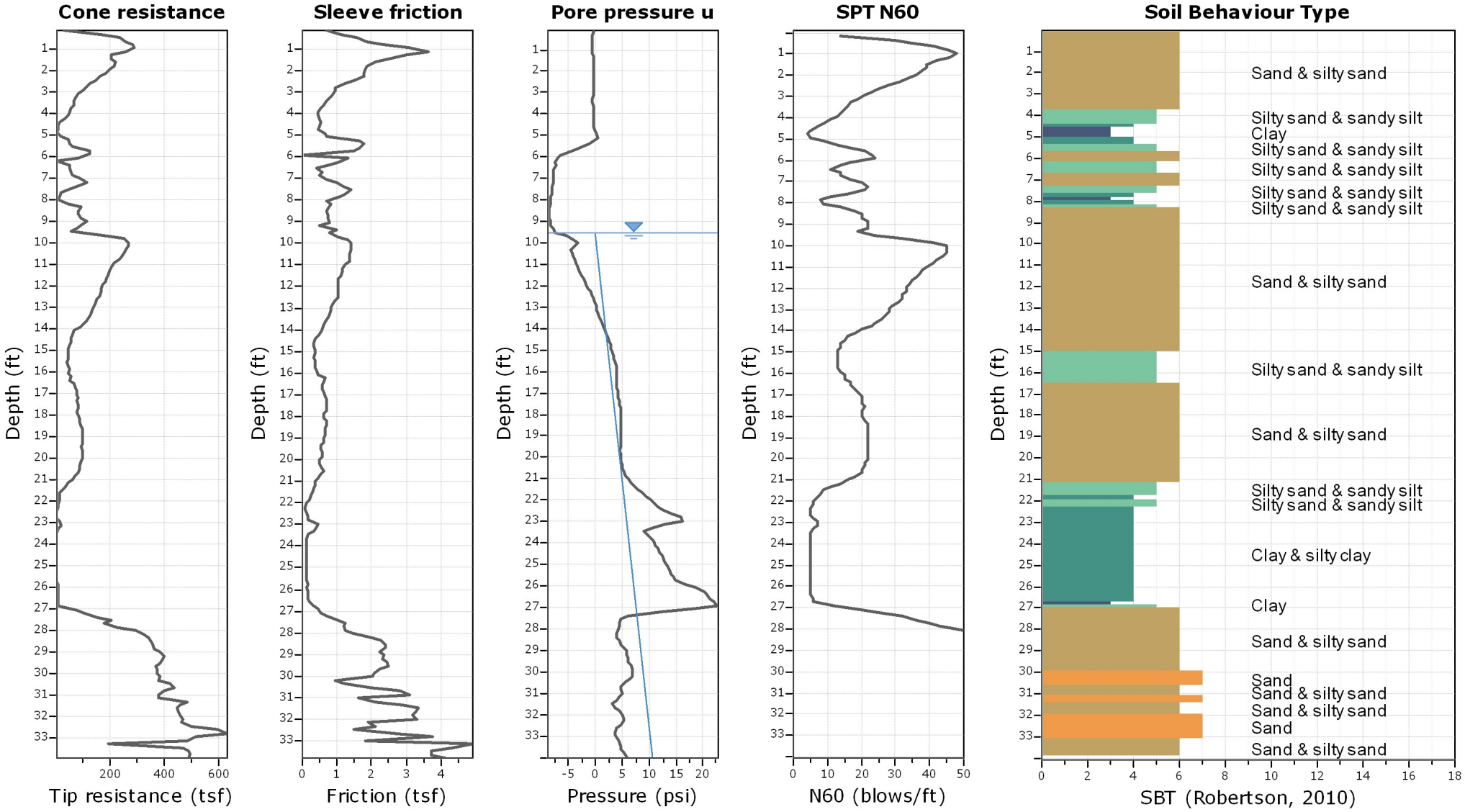
Project: ILM Terminal Expansion
Location: Wilmington, NC

CPT: CPT-5
Total depth: 40.19 ft, Date: 2/13/2018
Surface Elevation: 27.80 ft
Cone Type: Hogentogler 10T
Cone Operator: Mid-Atlantic Drilling



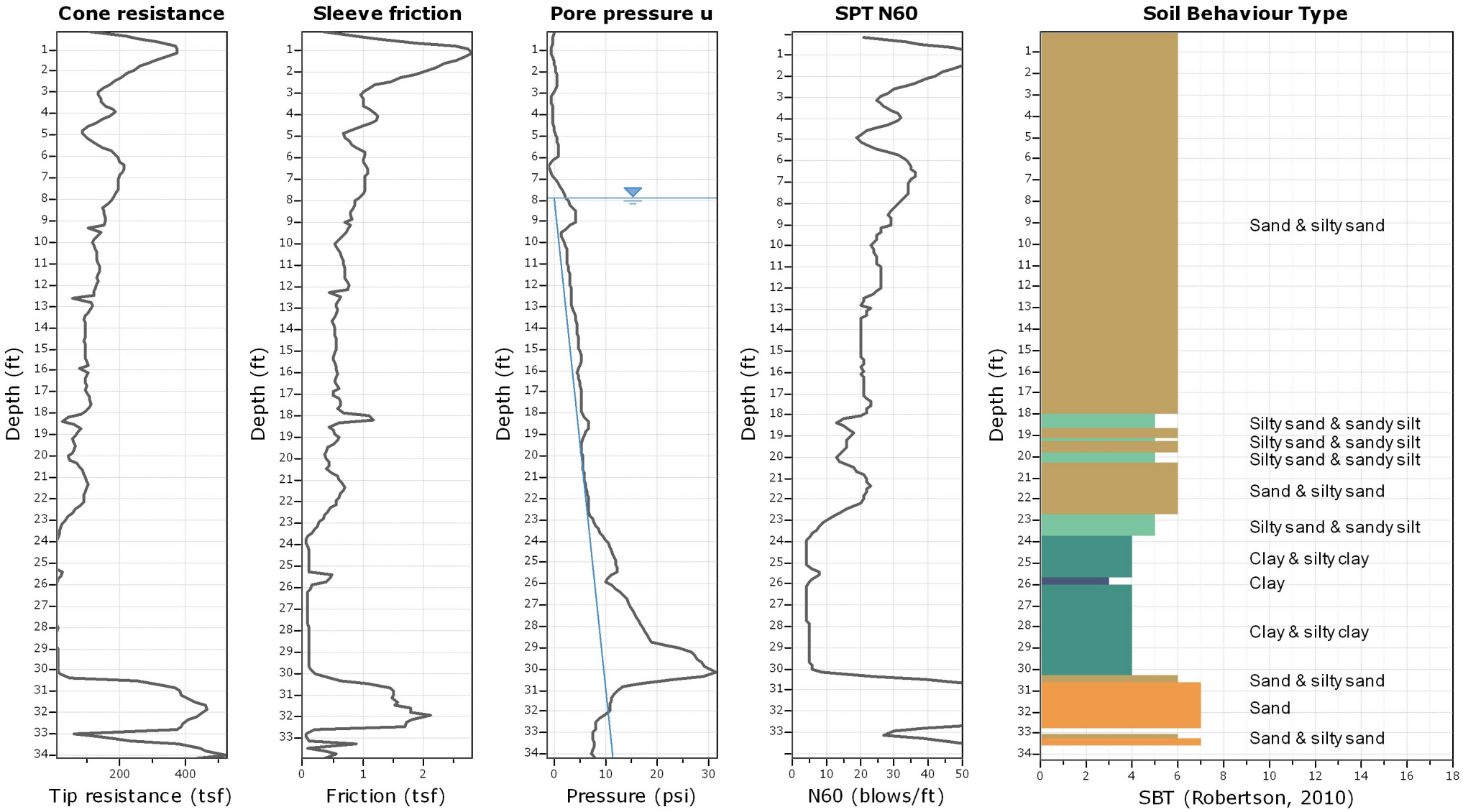
Project: ILM Terminal Expansion
Location: Wilmington, NC

CPT: CPT-6
Total depth: 33.96 ft, Date: 2/13/2018
Surface Elevation: 27.30 ft
Cone Type: Hogentogler 10T
Cone Operator: Mid-Atlantic Drilling



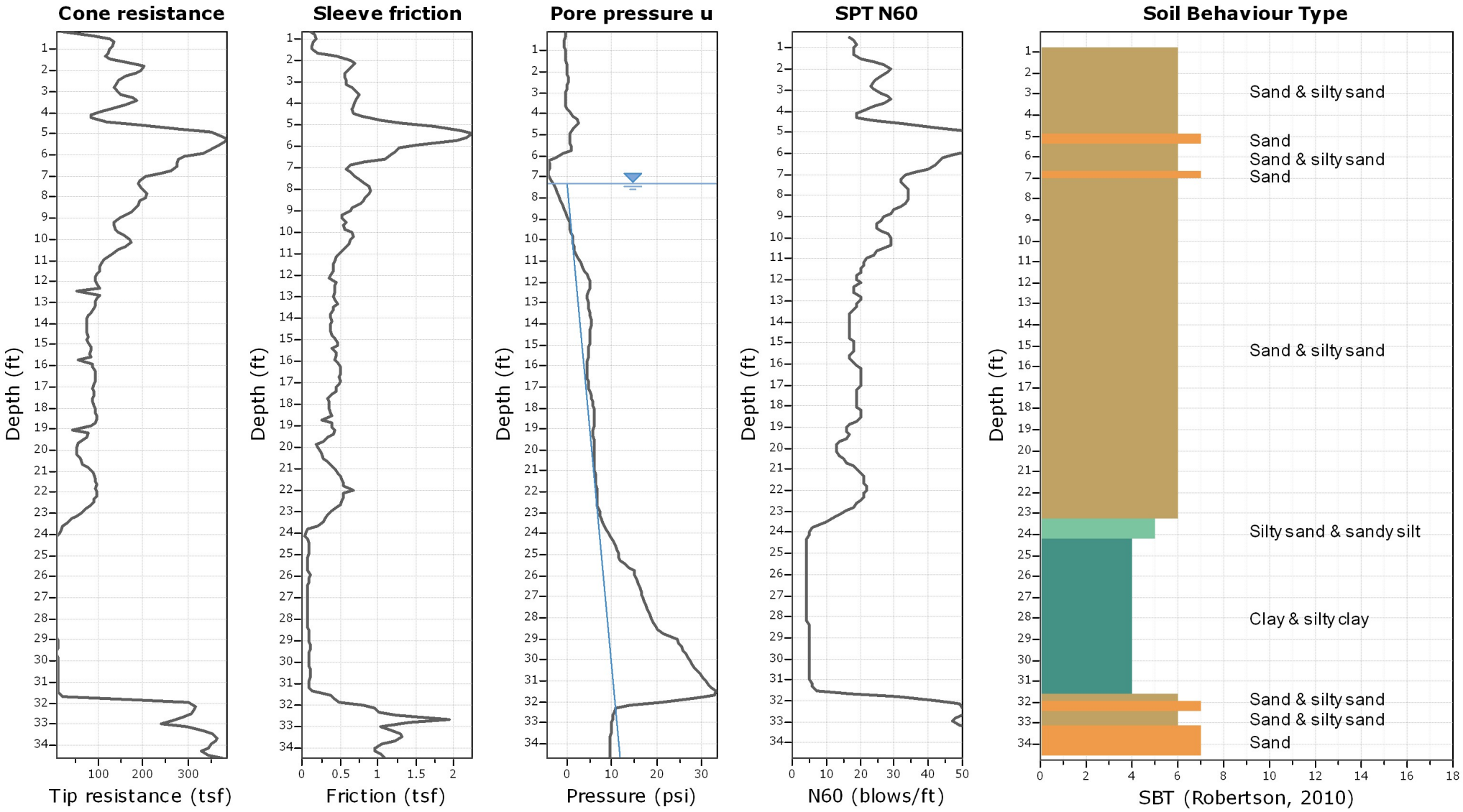
Project: ILM Terminal Expansion
Location: Wilmington, NC

CPT: CPT-7
Total depth: 34.12 ft, Date: 2/12/2018
Surface Elevation: 27.80 ft
Cone Type: Hogentogler 10T
Cone Operator: Mid-Atlantic Drilling



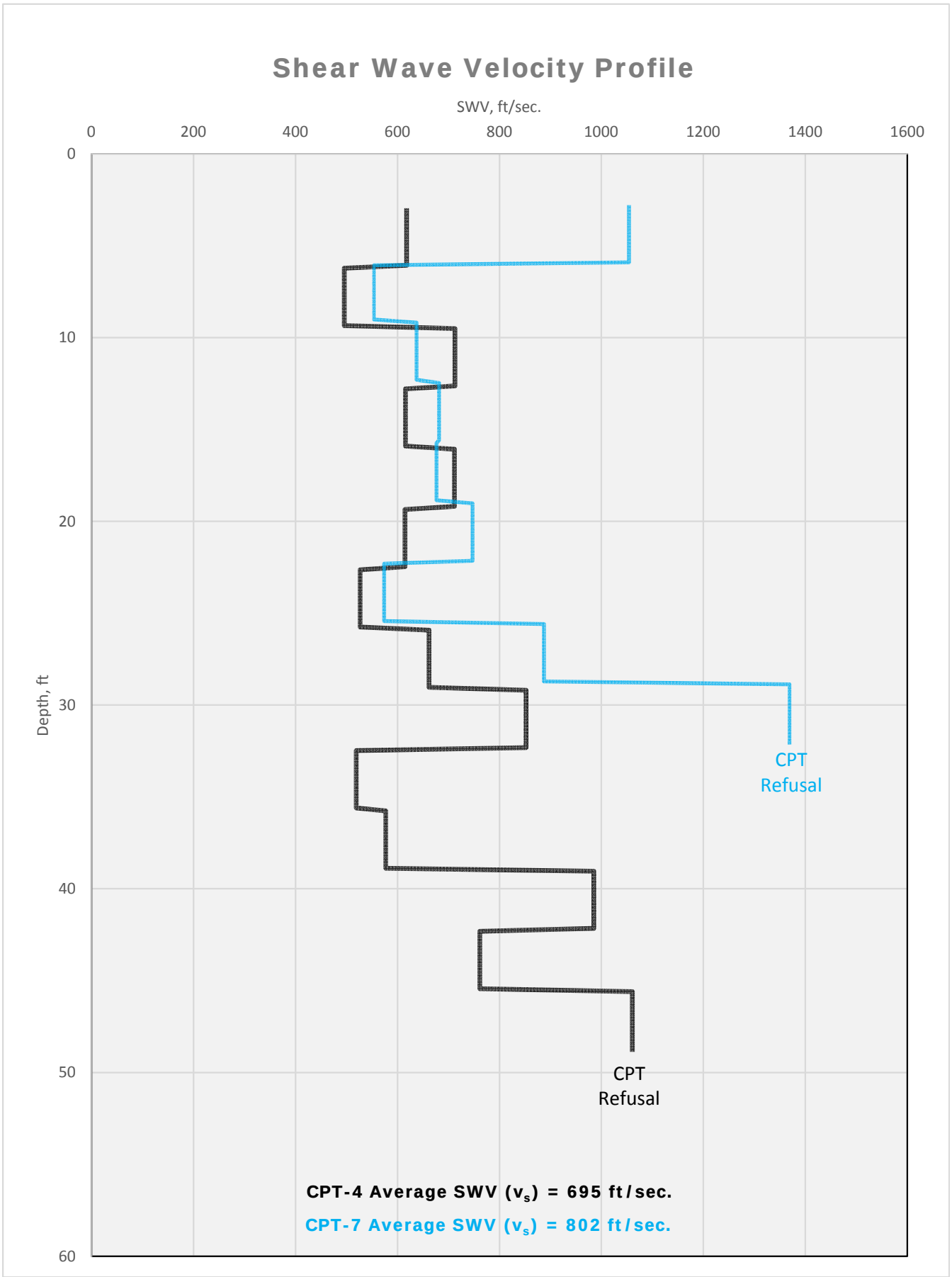
Project: ILM Terminal Expansion
Location: Wilmington, NC

CPT: CPT-8
Total depth: 34.61 ft, Date: 2/12/2018
Surface Elevation: 27.70 ft
Cone Type: Hogentogler 10T
Cone Operator: Mid-Atlantic Drilling



APPENDIX C

SHEAR WAVE VELOCITY PROFILE
LIQUEFACTION ANALYSIS

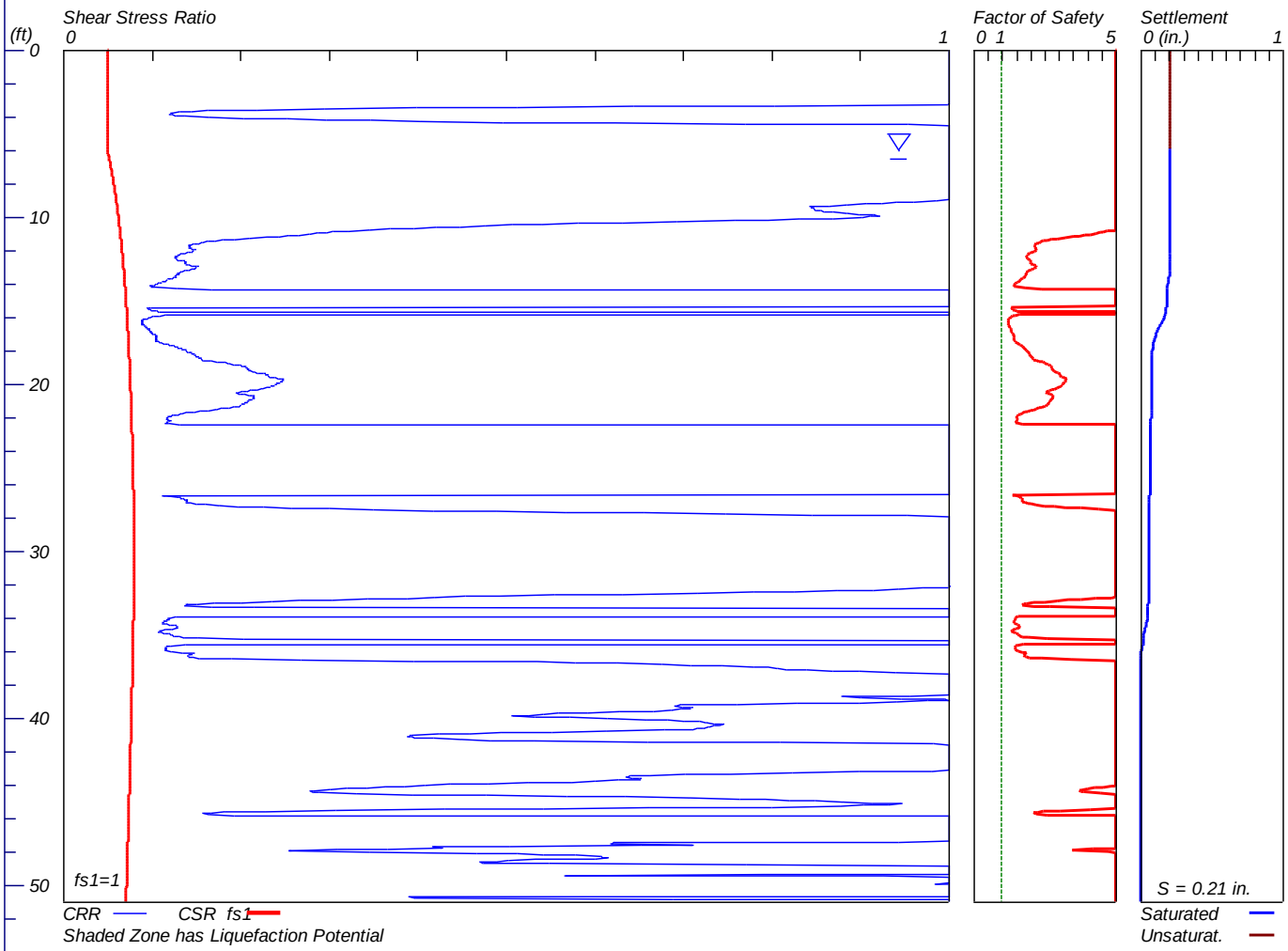

Shear Wave Velocity Profile
SWV, ft/sec.
0
200
400
600
800
1000
1200
1400
1600
Depth, ft
0
10
20
30
40
50
60
CPT
Refusal
CPT
Refusal
CPT-4 Average SWV (v_s) = 695 ft/sec.
CPT-7 Average SWV (v_s) = 802 ft/sec.

PRELIMINARY LIQUEFACTION ANALYSIS

ILM Terminal Expansion

Hole No.=CPT-4 Water Depth=6 ft Surface Elev.=27.8

Magnitude=7.3
Acceleration=0.0779g



LiquefyPro CivilTech Software USA www.civiltech.com

STEWART

Wilmington, NC

Plate A-1

APPENDIX D

SITE PHOTOGRAPHS



Photograph 1: View looking southeast from existing baggage area.



Photograph 2: View of site looking northwest from apron.



Photograph 3: View looking northeast along existing baggage area wall.



Photograph 4: View looking northeast along the proposed approx. southeast wall of the expansion.

GeoTechnologies, Inc.

Geotechnical and Construction Materials Testing Services

April 10, 2018

Mr. Eric Stumph, P.E.
Talbert & Bright, Inc.
4810 Shelley Drive
Wilmington, North Carolina 28405

Reference: Report of Pavement and Subsurface Investigation
Terminal Improvements
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Dear Sir:

GeoTechnologies has completed the authorized pavement and subsurface investigation to evaluate conditions for general site work including utility installation and pavement reconstruction for the proposed terminal improvements at Wilmington International Airport in Wilmington, North Carolina. The purpose of this report is to present the findings of our investigation and to make recommendations regarding site development, including grading and pavement construction.

PROJECT INFORMATION

A new concourse has been proposed, along with modification of the pedestrian bridge to the existing concourse, and additions to the main terminal structure. New utilities and expansion of existing utilities are expected, along with new pavements immediately adjacent to the new concourse and the terminal expansions to replace pavements which have been removed for construction.

GeoTechnologies performed a total of 9 pavement borings along the approximate perimeter of the proposed additions. The pavements were cored using a portable coring rig turning a diamond-impregnated coring bit. Borings were advanced using hand augers, and a dynamic cone penetrometer (DCP) was used at regular intervals to evaluate soil stiffness and consistency. Borings were extended to 5 feet below top of pavement. Upon completion, the holes were backfilled, packed, and patched. The borings were located by sighting off existing landmarks, and approximate locations are shown on the attached site plan, Figure 1.

PAVEMENT & SUBSURFACE CONDITIONS

The pavements consist of concrete over econocrete base. Thickness of the concrete ranged from 10 to 18 inches with an average thickness of 14.4 inches. Thickness of the econocrete base ranged from 5.5 to 8 inches with an average of 6.8 inches. The pavements appear to be in good condition. Numerous small patches are present along the edges of pavement slabs where spalls and a few corner breaks have been repaired. It is our understanding that these patches are not full-depth. A chain was used to randomly sound the patches to identify de-bonding. Approximately half of the patches which were sounded indicated at least some de-bonding from the underlying slab; these patches were marked with white paint as they were identified. None of the patches presently appear to be in danger of completely separating from the substrate concrete.

The concrete and econocrete cores appeared to be in good condition. The coarse aggregate used within these materials appears to be coastal limestone. The econocrete was bonded to the bottom of the concrete in cores P-5 and P-7. No signs of alkali-silica reaction (ASR) were observed in the pavements or the cores. However, a core has been sent off for petrographic analysis to confirm the presence or lack of ASR, along with determining general composition of the concrete. Photographs of the cores from each location are included in the attachments to this report.

The near surface soils consisted of medium dense silty to clean fine sands with Unified Soil Classifications of SM and SP. Some of the soils contained significant organic staining, though it has been our experience that these soils do not contain an appreciable organic content aside from occasional small roots. DCP penetration resistances were high in the upper 5 feet, only dropping below 15 blows per increment at 5 feet in boring P-9. Groundwater was not encountered in any of the borings. Detailed descriptions of the conditions encountered at the individual test boring locations are presented in Table 1 in the attachments to this report.

LABORATORY TESTS

Laboratory testing included natural moisture contents (ASTM D-2216) from soil samples in the top 3 feet from top of pavement, unconfined compressive strength tests (ASTM C39) on core samples of the econocrete, and splitting tensile tests (ASTM C-496) on core samples of the concrete.

Natural moisture contents ranged from 5.4 to 16.6 percent with an average of 10.7 percent. Optimum moisture content of these soils tends to range from approximately 10 to 15 percent. The soils generally appeared to be below optimum moisture content.

Compressive strength of the econocrete ranged from 1,280 to 1,840 psi with an average of 1,633 psi. Unit weight of the econocrete ranged from 124.3 to 130.9 pcf. The tensile strength of the concrete ranged from 624 to 691 psi, with an average of 657 psi. Unit weight of the concrete ranged from 129.5 to 130.9 pcf.

RECOMMENDATIONS

The following recommendations are made based upon a review of the attached test boring, our understanding of the proposed construction and previous projects at this airport, and past experience with similar projects and subsurface conditions. Should subsurface conditions adverse to those indicated by this report be encountered during construction, those differences should be reported to us for review and comment.

Soils. All the soils encountered within the borings will be suitable for re-use as fill though they may require moisture conditioning. As noted previously, some of the soils contain significant organic staining. These soils rarely contain organic contents which would prohibit their use as fill. As the soils were generally dry of optimum moisture content, water may need to be added to obtain compaction. If imported material is required, material available in the area is likely to include silty, clayey, and clean sands with Unified Soil Classifications of SM, SC, and SP. Quarry-processed materials will be suitable as well. Fill soils should be placed in accordance with FAA Item P-152.

Significant grading operations are not expected, though due to the relatively confined nature of the project area within existing pavements, these areas are likely to hold water during inclement weather, particularly during the cooler, wetter months of the year of October through March. Moisture conditioning of

soils in excavations and preparation of pavement subgrades will be difficult during the winter months of the year. We recommend that these operations be performed during the warmer, dryer months of the year.

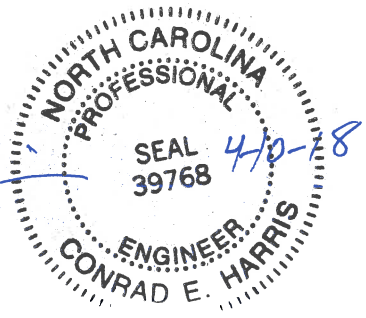
Pavements. The existing pavements are in good condition. The existing patches, though showing indications of de-bonding at many locations, still appear to be performing well. Many of the patches may be removed during demolition prior to construction of the new concourse. We recommend re-evaluating the patches once the exact limits of demolition are known to better isolate patches which may need to be removed and replaced.

Correlations from the DCP tests indicate that the in-place CBR values are more than 15 percent within at least the upper 3 feet below top of pavement, or the upper 1 to 2 feet below subgrade. These values were maintained to 5 feet below top of pavement in all borings except P-9. When prepared in accordance with FAA Item P-152, the soils at the airport often provide very high laboratory soaked CBR values in excess of 15 percent. We recommend that a CBR value of 15 percent, or a k-value of 200 pci be used for design of new pavements. It is our understanding that new pavements will largely be confined to areas immediately adjacent to structures and will likely only receive traffic from tugs, baggage carts, fuel trucks, and airport-owned passenger vehicles.

GeoTechnologies appreciates the opportunity to be of service on this project. Please do not hesitate to contact us if you have any questions regarding this submittal.

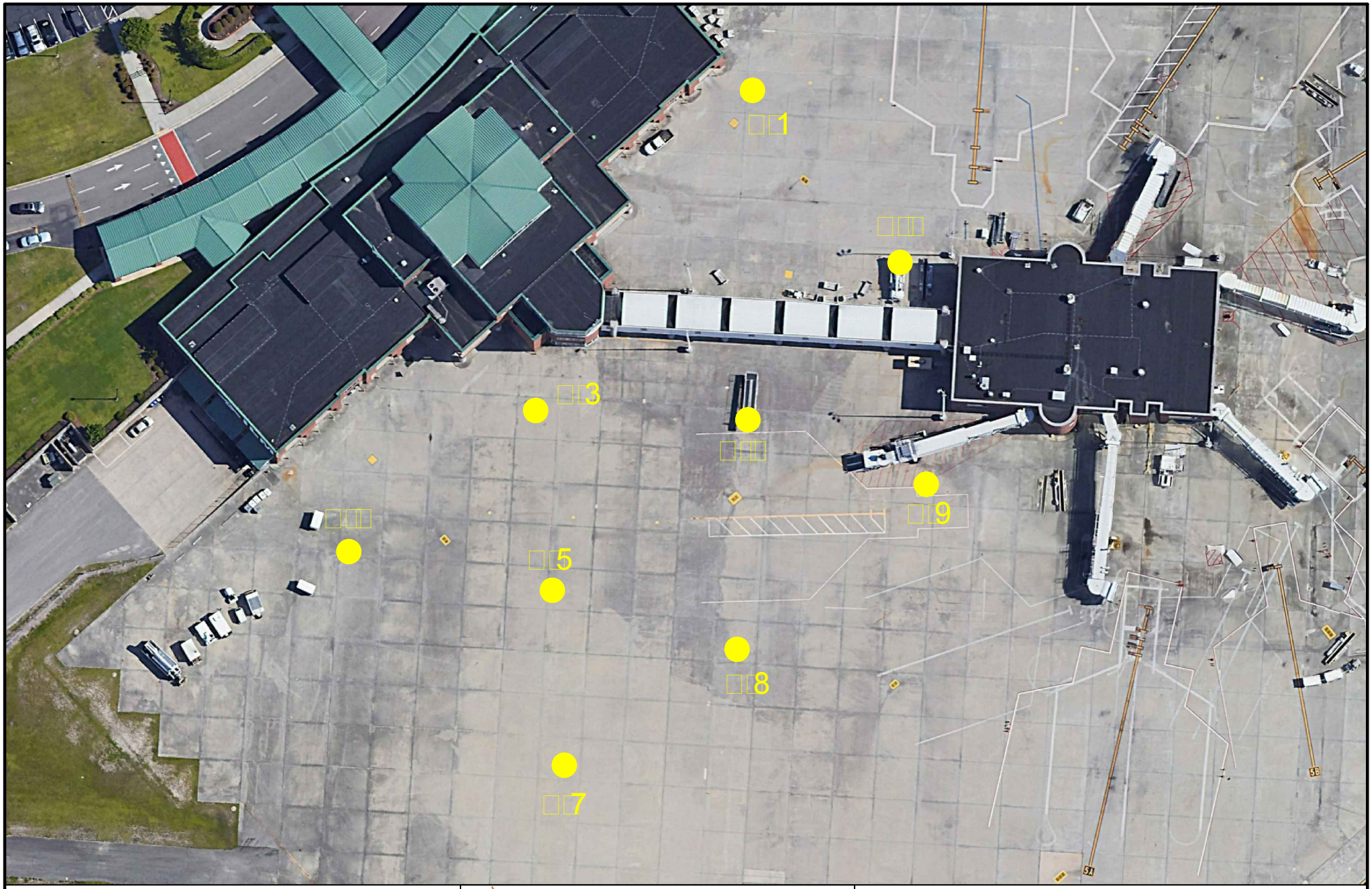
Sincerely,

GeoTechnologies, Inc.



Conrad E. Harris, P.E.
NC Registration No. 39768

ceh/pr-drh



□□□ □□□□□

□□M □□□r□ □□□□□□ □r□□□□ □□□□

□ □□□ □□□□□□□□ □r□□ □ □r□□□□

GeoTechnologies, Inc.

□□□□□□□□ □□□□□

□□ □ □□□1□17□1108□□

□□□ □□□ □ □□□1

BORING RECORDS

TABLE 1

TEST BORING SUMMARY

Terminal Improvements
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Boring	Depth (in.)	Description	USCS	Dynamic Cone Penetrometer	
				Depth (in)	Blows Per 1.75"
P-1	0 - 13	Concrete			
	13 - 21	Econocrete Base			
	21 - 24	Tan White Slightly Silty Fine SAND	SP	21	16/1.75"
	24 - 30	Black Silty Fine SAND	SM	36	16/1"
	30 - 60	Gray Tan Silty Fine SAND, Woven Fabric @ 36"	SM	60	15/1.75"
P-2	0 - 10	Concrete			
	10 - 17.75	Econocrete Base			
	17.75 - 34	Tan White Slightly Silty Fine SAND	SP	18	15/1"
	34 - 48	Brown Silty Fine SAND	SP	36	15/0.75"
	48 - 60	Tan Fine SAND	SP	60	15/1.25"
P-3	0 - 16.25	Concrete			
	16.25 - 23.75	Econocrete Base		24	15/1.5"
	23.75 - 60	Tan Brown Fine SAND	SP	36	15/1.25"
				60	15/1"
P-4	0 - 16	Concrete			
	16 - 22.5	Econocrete Base			
	22.5 - 33	Tan Fine SAND	SP	23	15/1.25"
	33 - 57	Brown Fine SAND	SP	36	15/1"
	57 - 60	White Fine SAND	SP	60	15/1.75"
P-5	0 - 18	Concrete			
	18 - 23.5	Econocrete Base			
	23.5 - 36	Tan Fine SAND	SP	24	15/1.25"
	36 - 60	Brown Slightly Silty Fine SAND	SP	36	15/1.25"
				60	7-15/1.75"
P-6	0 - 12.25	Concrete			
	12.25 - 18	Econocrete Base			
	18 - 30	Tan Fine SAND	SP	18	15/1.75"
	30 - 42	Brown Fine SAND	SP	36	15/1"
	42 - 60	White Tan Fine SAND	SP	60	15/1.75"

TABLE 1

TEST BORING SUMMARY

Terminal Improvements
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Boring	Depth (in.)	Description	USCS	Dynamic Cone Penetrometer	
				Depth (in)	Blows Per 1.75"
P-7	0 - 16.5	Concrete			
	16.5 - 23.5	Econocrete Base			
	23.5 - 30	Tan Fine SAND	SP	24	15/0.75"
	30 - 60	Brown Slightly Silty Fine SAND	SM	36	15/0.25"
				60	8-16/1.75"
P-8	0 - 16	Concrete			
	16 - 23.5	Econocrete Base			
	23.5 - 36	Tan Gray Fine SAND	SP	24	15/1.5"
	36 - 60	Brown Slightly Silty Fine SAND	SM	36	15/1.75"
				60	15/1.75"
P-9	0 - 12	Concrete			
	12 - 17.5	Econocrete Base			
	17.5 - 30	Tan Fine SAND w/ Clay Balls	SP	18	15/1.5"
	30 - 60	Brown Slightly Silty Fine SAND	SM	36	15/1"
	60	Obstruction in Side of Hole		60	3-5-7

TABLE 2

TEST BORING SUMMARY

Terminal Improvements
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Boring	Concrete (in.)	Econocrete (in.)	Total Thickness (in.)
P-1	13.0	8.0	21.0
P-2	10.0	7.75	17.75
P-3	16.25	7.5	23.75
P-4	16.0	6.5	22.5
P-5	18.0	5.5	23.5
P-6	12.25	5.75	18.0
P-7	16.5	7.0	23.5
P_8	16.0	7.5	23.5
P-9	12.0	5.5	17.5

LABORATORY TESTS

TABLE 3

NATURAL MOISTURE CONTENTS

Terminal Improvements
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Boring	Depth (in.)	Moisture Content (%)
P-2	18	9.7
P-2	36	9.0
P-3	24	16.6
P-3	36	12.6
P-4	23	9.9
P-5	24	5.4
P-5	36	8.2
P-6	18	11.4
P-6	36	11.3
P-7	24	7.7
P-7	36	11.9
P-8	24	14.1
P-8	36	13.1
P-9	18	11.5
P-9	36	7.9

GeoTechnologies, Inc.

LF-30

CONCRETE CORE DATA SHEET

ASTM C-42, C-39, C-496

JOB NAME: ILM Termainal Improvements **JOB NO.:** 1-17-1108-EA **DATE:** 4/6/2018

LOCATION: Wilmington, NC **PREP BY:** CAS **TESTED BY:** CAS

COMPRESSIVE STRENGTH

CORE #	DATE TESTED	UNIT WT. (PCF)	LENGTH (in.) (Before Cap)	LENGTH (in.) (w/ Cap)	DIAMETER (in.)	AREA (in.²)	L/D RATIO	STRENGTH CORR. FACTOR	TOTAL LOAD (lbs.)	CORRECTED STRENGTH (psi.)
P-1	4/6/2018	130.9	6.95	7.11	3.66	10.52	1.94	1.00	18,930	1,799
P-3	4/6/2018	129.5	6.19	6.35	3.66	10.52	1.73	0.98	19,754	1,840
P-7	4/6/2018	124.3	5.47	5.62	3.66	10.52	1.54	0.96	14,026	1,280
P-9	4/6/2018	126.0	5.45	5.69	3.66	10.52	1.55	0.96	17,683	1,614
									Average	1,633

TENSILE STRENGTH

CORE #	DATE TESTED	UNIT WT. (PCF)	LENGTH (in.) (Before Cap)	DIAMETER (in.)	AREA (in.²)	TOTAL LOAD (lbs.)	TENSILE STRENGTH (psi.)
P-4	4/6/2018	130.9	6.79	3.66	10.52	26,967	691
P-6	4/6/2018	129.5	6.90	3.66	10.52	24,758	624
						Average	657

CORE PHOTOGRAPHS



P-1





P-2



P-3



P-4



P-5



P-6



P-7



P-8



P-9

GeoTechnologies, Inc.

Geotechnical and Construction Materials Testing Services

May 23, 2018

Mr. Eric Stumph, P.E.
Talbert & Bright, Inc.
4810 Shelley Drive
Wilmington, North Carolina 28405

Reference: Report of Subsurface Investigation
Duct Bank Near Outbound Baggage
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Dear Sir:

GeoTechnologies has completed a series of pavement borings to locate two duct banks running across the outbound baggage bays and in the "tunnel" between inbound baggage and outbound baggage. Power and communication utilities are run through the duct banks, with the power marked in the west duct bank and communications in the east duct bank.

A series of borings were performed at the south end of the tunnel (location A), and another at the south end of outbound baggage (location B). These areas are marked on Figure 1 in the attachments to this report. The concrete pavements were cored with a diamond-impregnated coring bit, and then the borings were extended with hand augers until a buried structure was encountered or the borings reached a couple feet beyond the anticipated depths. Upon completion, the bore holes were backfilled, packed, and patched. A total of 18 borings were performed. Approximate layouts of the borings are presented in Figures 2A and 2B. The estimated limits of the duct banks, using information from both locations, are marked on these figures as well. Pavement section details, boring depth, and boring locations are presented in Table 1 in the attachments to this report. Location measurements were made from the face of the curb west of the borings.

Thickness of the concrete at location A ranged from 15 to 16 inches. The concrete was underlain by approximately 1 to 5 inches of washed stone. The soils encountered consisted of silty fine sands with some gravel and occasional small pieces of construction debris. Buried concrete structures were encountered at depths ranging from 20.5 to 36 inches below the top of the concrete. The structure where the power was marked was encountered at 29 inches below top of concrete and appears to be less than 17 inches wide. The structure encountered where communications was marked was at 36 inches below top of concrete and appears to be at least 2 feet wide. Boring A-4, attempting to find the inside edge of the structure, encountered another structure at 20.5 inches below top of concrete.

Thickness of the concrete at location B ranged from 14 to 14.25 inches. Under the concrete was an econocrete base which ranged in thickness from 5.5 to 8 inches. The soils encountered consisted of silty fine sands. Buried concrete structures were encountered at depths ranging from 30 to 47 inches below top of concrete. The structure where the power was marked was encountered at 30 inches below top of concrete and appears to be less than 9 inches wide. The structure where communications was marked was encountered at 47 inches below top of concrete and appears to be at least 57 inches wide.

Combining the information from both locations indicates that the west duct bank is slightly greater than half a foot in width and starts approximately 5.75 feet from the face of the curb. The east duct bank appears to be approximately 5.5 feet in width and extends to approximately 13.5 feet from the face of the curb. The greater depth of the east duct bank at location B may be due to the presence of a nearby waterline, though the west duct bank does not appear to change in elevation relative to location A.

GeoTechnologies appreciates the opportunity to be of service on this project. Please do not hesitate to contact us if you have any questions regarding this submittal.

Sincerely,

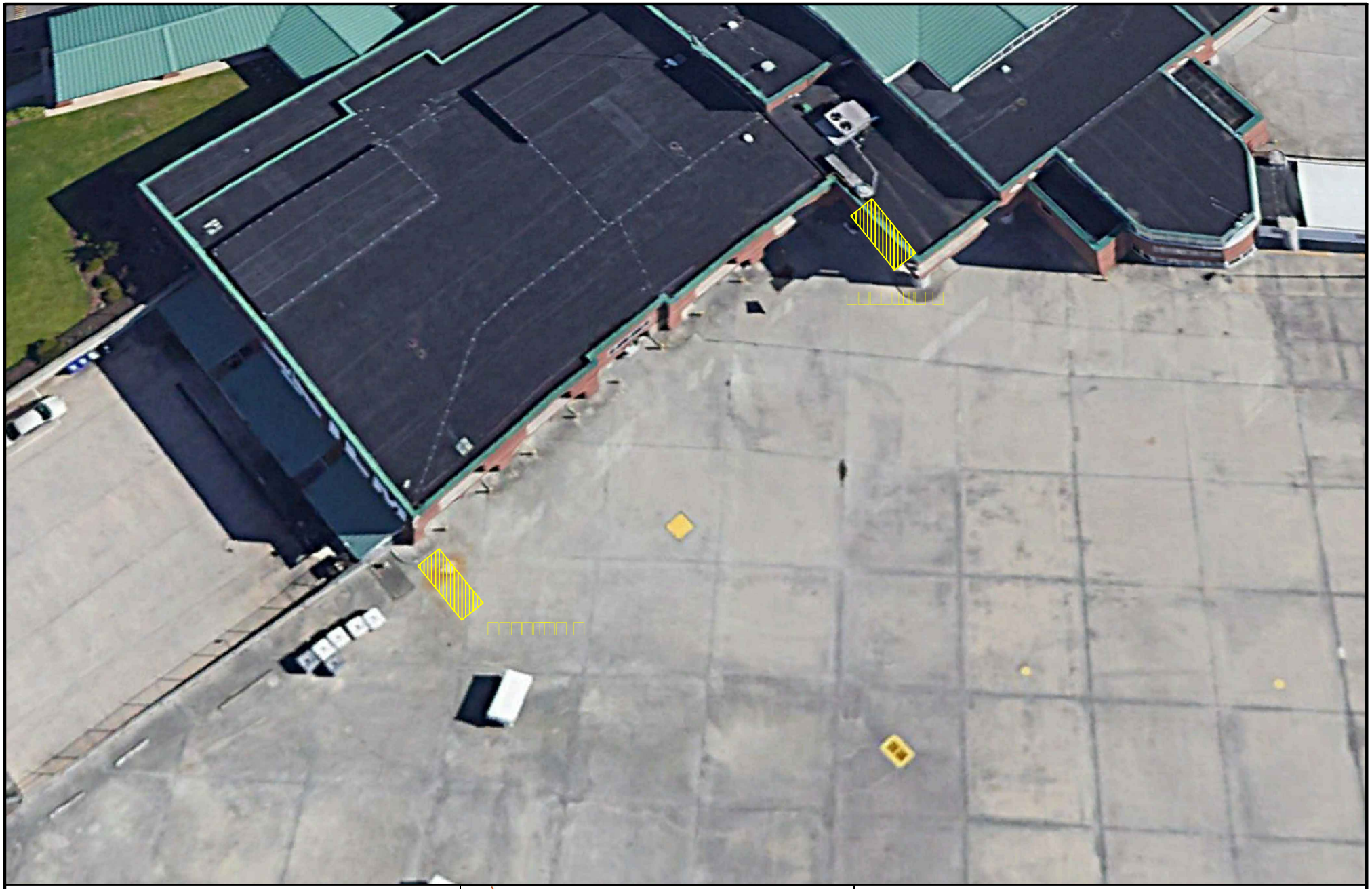
GeoTechnologies, Inc.

NORTH CAROLINA PROFESSIONAL SEAL 39768 ENGINEER CONRAD E. HARRIS

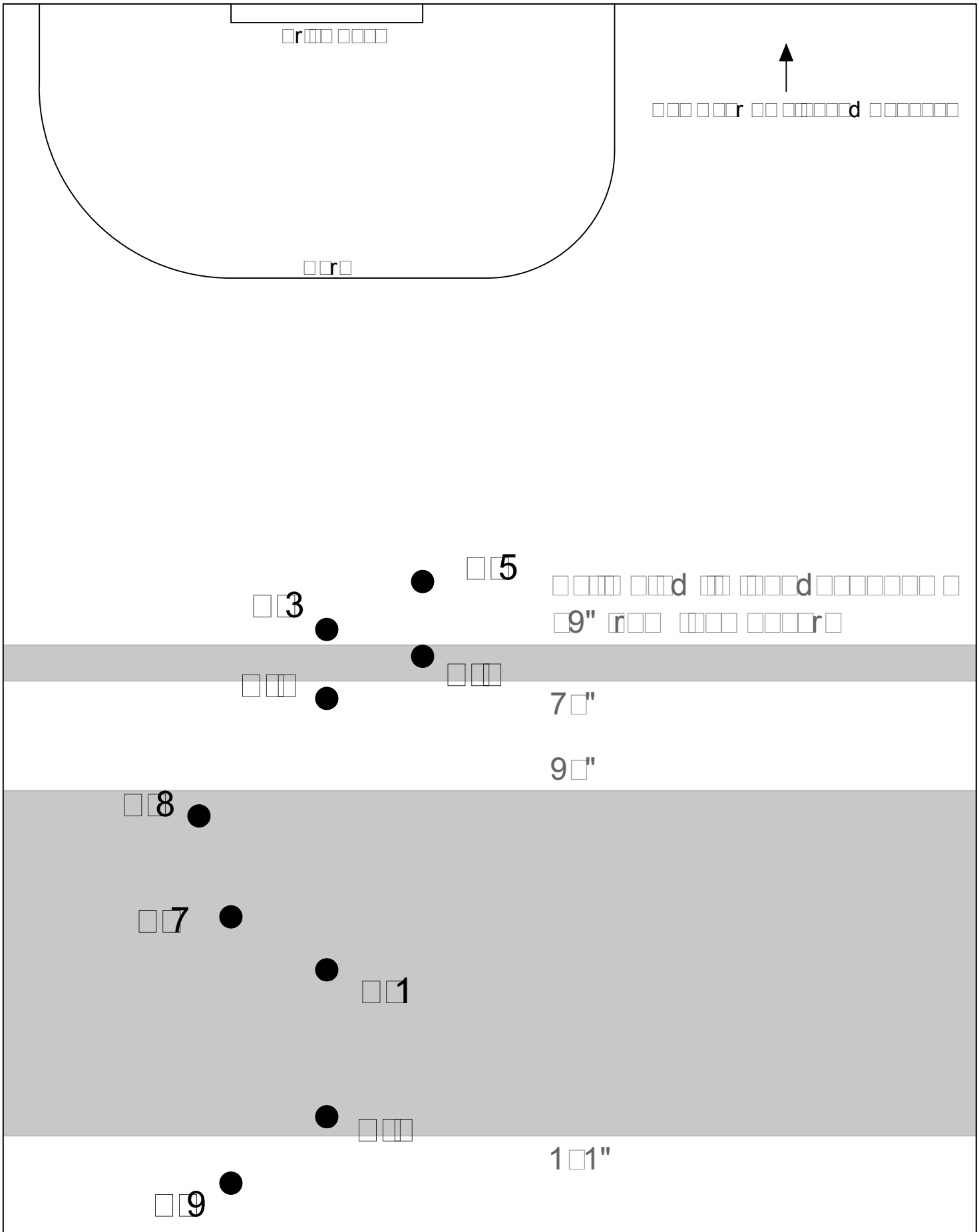
5-23-18

Conrad E. Harris, P.E.
NC Registration No. 39768

ceh/pr-mrp



GeoTechnologies, Inc.



GeoTechnologies, Inc.

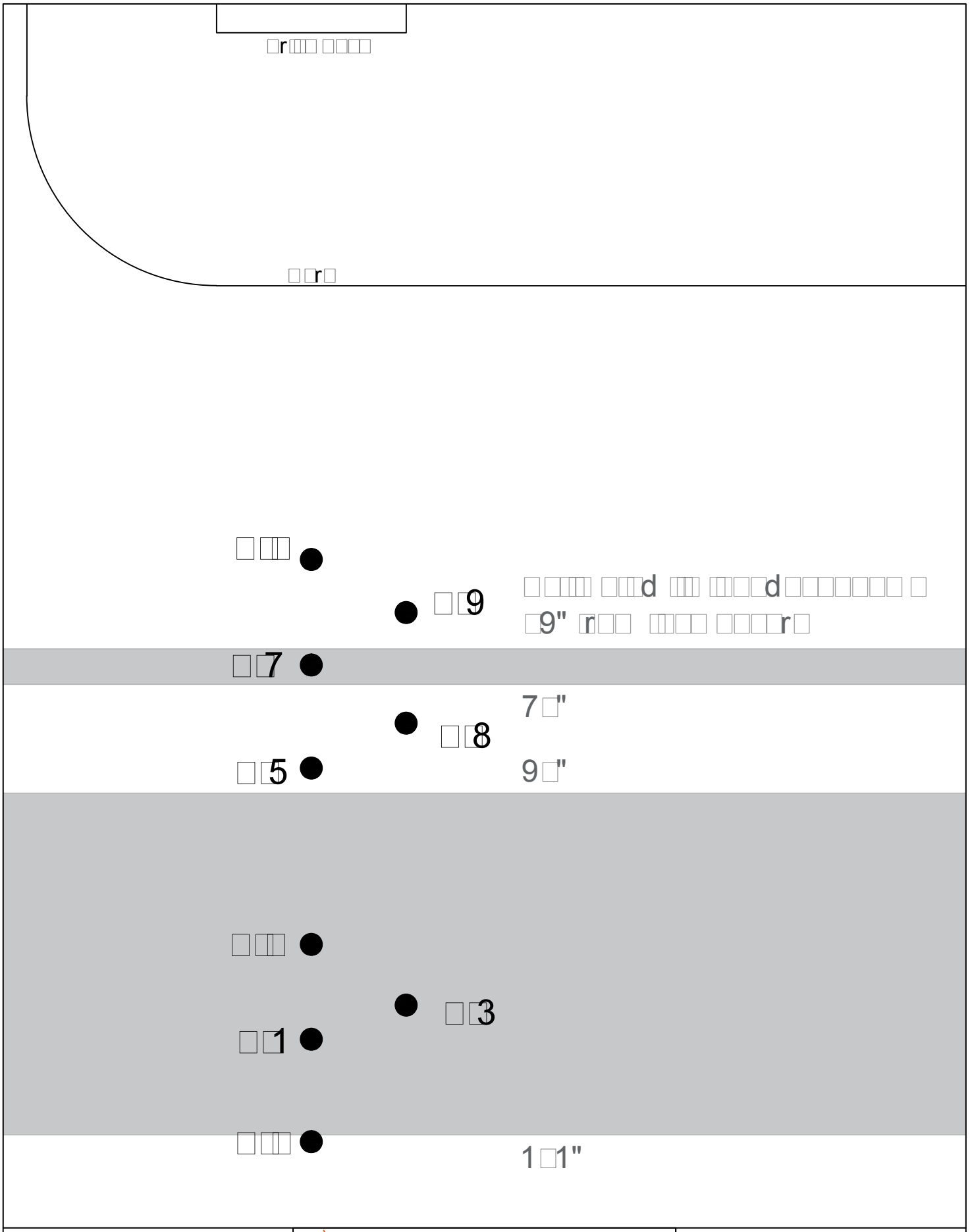

9
7
8
5
3
1
9" r
7"
9"
1"

TABLE 1

TEST BORING SUMMARY

Outbound Baggage Duct Banks
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Boring	Distance - Face of Curb to Center of Hole (in.)	Depth (in.)	Description
A-1	143	0 - 15	Concrete
		15 - 19	Washed Stone
		19 - 36	Brown Silty Fine SAND w/ Some Gravel
		36	Hand Auger Refusal on Concrete
A-2	162.5	0 - 16	Concrete
		16 - 21	Washed Stone
		21 - 48	Brown Silty Fine SAND w/ Some Gravel
		36	Top of Concrete Structure on Inside Edge of Hole
A-3	136.5	0 - 15	Concrete
		15 - 20	Washed Stone
		20 - 36	Brown Silty Fine SAND w/ Some Gravel
		36	Hand Auger Refusal on Concrete
A-4	125	0 - 15	Concrete
		15 - 18	Washed Stone
		18 - 20.5	Brown Silty Fine SAND
		20.5	Hand Auger Refusal on Concrete
A-5	91.5	0 - 16	Concrete
		16- 21	Washed Stone
		21 - 48	Brown Silty Fine SAND w/ Some Gravel
A-6	52	0 - 15.5	Concrete
		15.5 - 18.5	Washed Stone
		18.5 - 48	Brown Silty Fine SAND w/ Some Gravel
A-7	72	0 - 15.5	Concrete
		15.5 - 16.5	Washed Stone
		16.5 - 29	Brown Silty Fine SAND w/ Some Gravel
		29	Hand Auger Refusal on Concrete
A-8	83	0 - 16	Concrete
		16 - 21	Washed Stone
		21 - 72	Brown Silty Fine SAND w/ Some Gravel
		72 - 78	Yellow Gray Fine Sandy CLAY

TABLE 1

TEST BORING SUMMARY

Outbound Baggage Duct Banks
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Boring	Distance - Face of Curb to Center of Hole (in.)	Depth (in.)	Description
A-9	62	0 - 14.25	Concrete
		14.25 - 18	Washed Stone
		18 - 48	Brown Silty Fine Sand w/ Some Gravel
B-1	130	0 - 14	Concrete
		14 - 19.5	Econocrete Base
		19.5 - 47	Brown Tan Silty Fine SAND
		47	Hand Auger Refusal on Concrete
B-2	157.5	0 - 14	Concrete
		14 - 19.5	Econocrete Base
		19.5 - 47	Brown Tan Silty Fine SAND
		47	Hand Auger Refusal on Concrete
B-3	66	0 - 14	Concrete
		14 - 21	Econocrete Base
		21 - 42	Brown Tan Silty Fine SAND
		42	Refusal on Possible Log
B-4	79	0 - 14	Concrete
		14 - 22	Econocrete Base
		22 - 78	Brown Tan Silty Fine SAND
B-5	57	0 - 14	Concrete
		14 - 21	Econocrete Base
		21 - 60	Brown Tan Silty Fine SAND
B-6	71	0 - 14	Concrete
		14 - 21.5	Econocrete Base
		21.5 - 30	Brown Tan Silty Fine SAND
		30	Hand Auger Refusal on Concrete
B-7	120	0 - 14	Concrete
		14 - 21.5	Econocrete Base
		21.5 - 47	Brown Tan Silty Fine SAND
		47	Hand Auger Refusal on Concrete

TABLE 1

TEST BORING SUMMARY

Outbound Baggage Duct Banks
Wilmington International Airport
Wilmington, North Carolina
GeoTechnologies Project No. 1-17-1108-EA

Boring	Distance - Face of Curb to Center of Hole (in.)	Depth (in.)	Description
B-8	101	0 - 14	Concrete
		14 - 21	Econocrete Base
		21 - 47	Brown Tan Silty Fine SAND
		47	Hand Auger Refusal on Concrete
B-9	170	0 - 14	Concrete
		14 - 21	Econocrete Base
		21 - 72	Brown Tan Silty Fine SAND

LOWCOUNTRY
LOCATING LLC

ILM TERMINAL EXPANSION PROJECT- SUE RESULTS

- PROVIDED A GROUND PENETRATING RADAR (GPR) SWEEP USING A GRID PATTERN FOR THE ENTIRE PROJECT AREA----THE RESULTS WERE LIMITED WHICH WERE BELIEVED TO BE CAUSED BY THE CONCRETE THICKNESS CAUSING DISRUPTION OF THE RADAR SIGNAL

- USED BOTH GPR AND ELECTROMAGNETIC METHODS TO PROPERLY IDENTIFY AND MARK THE ELECTRIC LINES, COMMUNICATION LINES, WATER LINES, SEWER LINES, AND STORM DRAINAGE LINES.

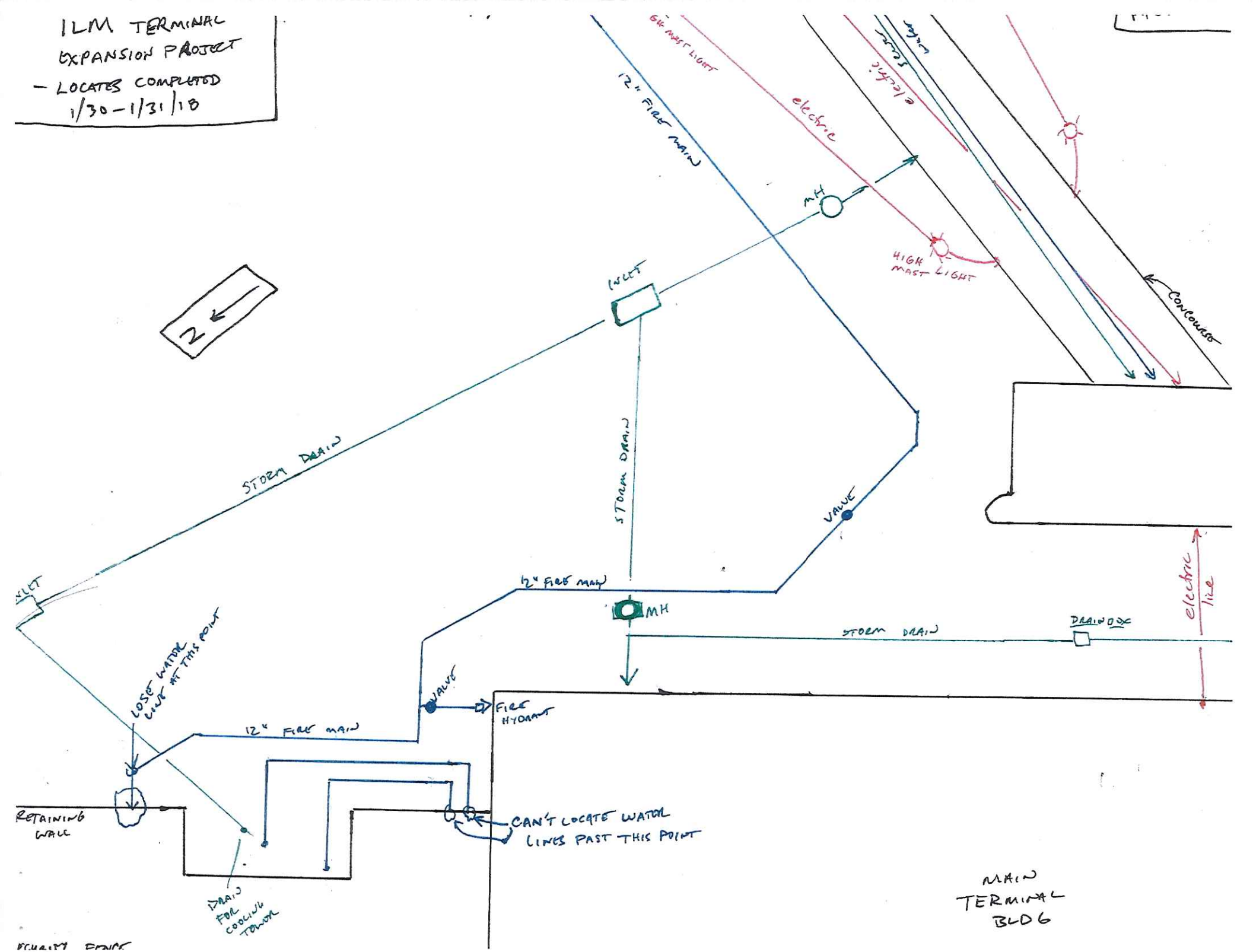
- COLORS OF PAINT USED AND WHAT THEY REPRESENT WERE AS FOLLOWS--- BLUE= WATER LINES, RED= ELECTRIC LINES, ORANGE= COMMUNICATION LINES, GREEN= SANITARY SEWER AND DRAINAGE LINES (NOTE: THE ONLY SANITARY SEWER LOCATED WAS UNDER THE CONCOURSE ALONG THE WALKWAY)

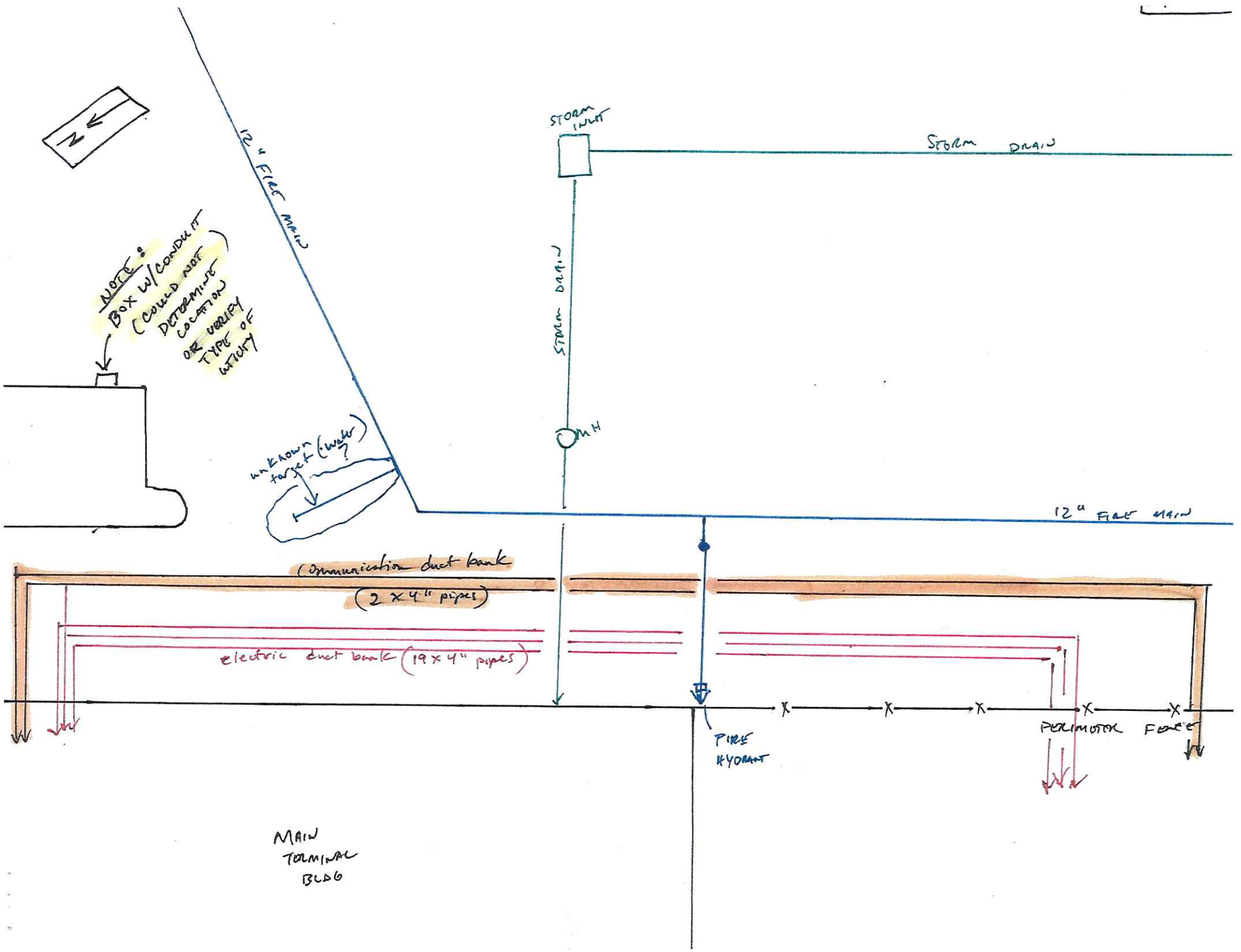
- ALL UTILITY LINES THAT WERE ON THE PROVIDED EXISTING DRAWINGS WERE IDENTIFIED AND LOCATED.

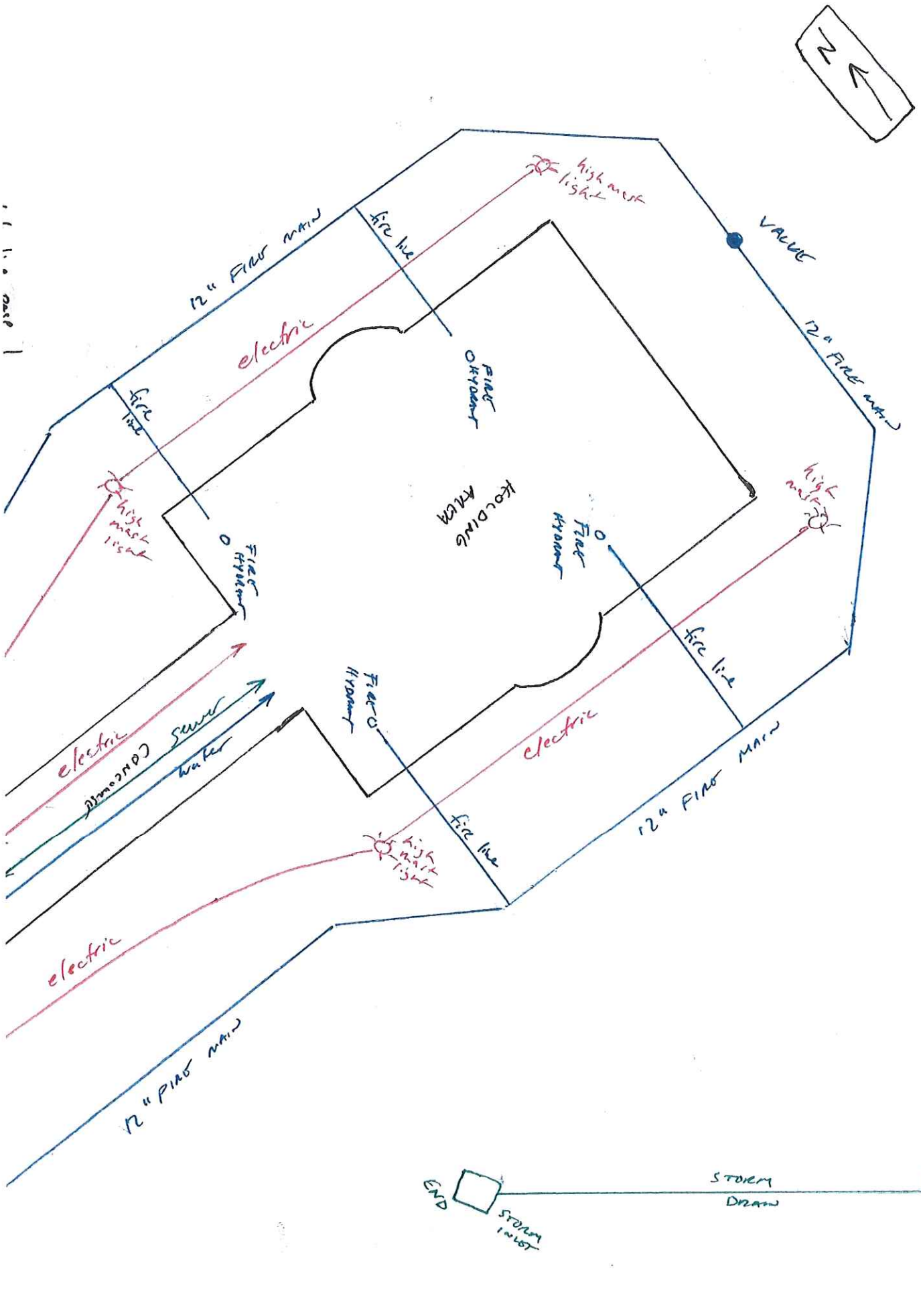
COMMENTS/ QUESTIONS

- ELECTRIC LINES FEEDING HIGH MAST LIGHTS GO UNDERNEATH CONCOURSE. IS THIS THE SOURCE FOR THE LIGHTS? IF NOT, WHERE IS THE SOURCE FEED? THERE WERE NO PLANS TO SHOW THIS.
- THERE IS A SMALL METAL JUNCTION BOX ON THE SIDE OF THE CONCOURSE NEAR GROUND LEVEL WITH A CONDUIT COMING OUT OF IT. (HIGHLIGHTED IN YELLOW ON THE SUPPORTED HAND DRAWINGS) COULD NOT LOCATE OR DETERMINE WHAT IT WAS
- THERE WERE NO TAXIWAY LIGHTS OR FAA CABLES ON THE PROVIDED UTILITY DRAWINGS. DO THOSE RUN THROUGH THE PROPOSED PROJECT AREA?

Lowcountry Locating LLC****Post Office Box 61208****North Charleston, SC 29419****
Phone: 843.810.6979****Email: matthew@lowcountrylocating.com


ILM TERMINAL
EXPANSION PROJECT
– LOCATES COMPLETED
1/30 – 1/31/18
64' MAST LIGHT
12" FIRE MAIN
electric
MH
HIGH MAST LIGHT
CONCOURSE
INLET
STORM DRAIN
VALVE
12" FIRE MAIN
MH
STORM DRAIN
DRAIN INLET
electric line
LOSE WATER LINE AT THIS POINT
VALVE
FIRE HYDRANT
12" FIRE MAIN
RETAINING WALL
CAN'T LOCATE WATER LINES PAST THIS POINT
DRAIN FOR COOLING TOWER
MAIN TERMINAL BLDG


N
12" FIRE MAIN
STORM INLET
STORM DRAIN
STORM DRAIN
MH
NOTE:
BOX W/CONDUIT
(COULD NOT
DETERMINE
LOCATION
OR VERIFY
TYPE OF
UTILITY
UNKNOWN
target (water?)
12" FIRE MAIN
(ommunication duct bank
(2 x 4" pipes)
electric duct bank (19 x 4" pipes)
FIRE
HYDRANT
PERIMETER
FENCE
MAIN
TERMINAL
BLDG


12" FIRE MAIN
fire line
high mast light
electric
VALVE
12" FIRE MAIN
fire line
FIRE HYDRANT
HOUSING ATLAS
high mast light
FIRE HYDRANT
FIRE HYDRANT
high mast light
electric
COMMUNICATION
sewer
water
fire line
FIRE HYDRANT
electric
12" FIRE MAIN
high mast light
fire line
electric
12" FIRE MAIN
END
STORM INLET
STORM DRAIN
STORM INLET

Wilmington International Airport (ILM) July 2018 Airline Schedule Approximate and Subject to Change

Arriving Flights							Departing Flights					
From	Arrival	Airline	Flight #	Equipment	Seats	Turn Around	To	Departure	Airline	Flight #	Equipment	Seats
						Overnight	**CLT**	5:38A	AA	5219	CRJ 900	76
						Overnight	**ATL**	6:00A	DL	2631	MD-88	149
						Overnight	**PHL**	6:00A	AA	4787	ERJ 145	50
						Overnight	**LGA**	6:29A	AA	3780	ERJ 140	44
						Overnight	**CLT**	7:10A	AA	641	A319	128
						Overnight	**ATL**	7:15A	DL	5452	CRJ 200	50
CLT	9:01A	AA	5189	CRJ 900	76	0:33	**CLT**	9:34A	AA	5189	CRJ 900	76
LGA	9:16A	AA	3320	ERJ 140	44	0:53	**LGA**	10:09A	AA	3320	ERJ 140	44
ATL	9:31A	DL	4083	CRJ 200	50	0:29	**ATL**	10:00A	DL	4083	CRJ 200	50
IAD	10:04A	UA	3956	CRJ 200	50	0:31	**IAD**	10:35A	UA	3949	CRJ 200	50
PHL	10:41A	AA	4801	ERJ 145	50	0:30	**PHL**	11:11A	AA	4801	ERJ 145	50
CLT	10:45A	AA	5246	CRJ 900	76	0:30	**CLT**	11:15A	AA	5246	CRJ 900	76
ORD	10:50A	UA	4804	CRJ 200	50	0:45	**ORD**	11:35A	UA	3964	CRJ 200	50
LGA	11:17A	DL	5542	CRJ 200	50	0:57	**LGA**	12:14P	DL	5561	CRJ 200	50
ATL	12:15P	DL	5185	CRJ 200	50	0:29	**ATL**	12:44P	DL	5185	CRJ 200	50
CLT	12:18P	AA	4699	ERJ 175	76	0:30	**CLT**	12:48	AA	4699	ERJ 175	76
ORD	12:26P	AA	4059	CRJ 700	65	0:30	**ORD**	12:56P	AA	4059	CRJ 700	65
CLT	1:51P	AA	5404	CRJ 900	76	0:36	**CLT**	2:27P	AA	5404	CRJ 900	76
ATL	2:33P	DL	3327	CRJ 200	50	0:27	**ATL**	3:00P	DL	3327	CRJ 200	50
LGA	3:10P	AA	3943	ERJ 140	44	0:29	**LGA**	3:39P	AA	3943	ERJ 140	44
CLT	3:35P	AA	5125	CRJ 700	65	0:32	**CLT**	4:07P	AA	5125	CRJ 700	65
PHL	5:11P	AA	5342	CRJ 900	76	0:33	**PHL**	5:44P	AA	5290	CRJ 900	76
ORD	5:11P	UA	4835	CRJ 200	50	0:35	**ORD**	5:46P	UA	3953	CRJ 200	50
CLT	5:14P	AA	5439	CRJ 900	76	0:33	**CLT**	5:47P	AA	5352	CRJ 900	76
ATL	6:20P	DL	5173	CRJ 200	50	0:29	**ATL**	6:49P	DL	5415	CRJ 200	50
IAD	6:54P	UA	3960	CRJ 200	50	0:41	**IAD**	7:35P	UA	3950	CRJ 200	50
CLT	7:21P	AA	5531	CRJ 900	76	0:48	**CLT**	8:09P	AA	5531	CRJ 900	76
CLT	8:56P	AA	5483	CRJ 900	76	Overnight						
ATL	9:08P	DL	2382	MD-88	149	Overnight						
LGA	9:56P	AA	3550	ERJ 140	44	Overnight						
PHL	10:52P	AA	4804	ERJ 145	50	Overnight						
ATL	11:08P	DL	3423	CRJ 200	50	Overnight						
CLT	11:35P	AA	1999	A319	128	Overnight						
Saturday Only:												
DFW	2:36P	AA	5860	CRJ 900	76	0:48	**DFW**	3:24P	AA	5860	CRJ 900	76

STATE OF NORTH CAROLINA **AGREEMENT**

NEW HANOVER COUNTY AIRPORT AUTHORITY

THIS CONTRACT made and entered into this _____ day of _____, 2018 by and between NEW HANOVER COUNTY AIRPORT AUTHORITY a political subdivision of the State of North Carolina, hereinafter referred to as "Owner" or "Authority" ; and _____, hereinafter referred to as "Contractor."

W I T N E S S E T H:

That Contractor, for the consideration hereinafter fully set out, hereby agrees with Owner as follows:

DEFINITIONS

Addenda. Written or graphic instruments issued prior to the opening of bids that clarify, correct, or change the Bidding Requirements or the Contract Documents.

Agreement. The written instrument evidencing the covenant between Owner and the Contractor performing the Work.

Application for Payment. The form acceptable to Owner which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

Bidding Documents. The bidding requirements and the proposed Contract Documents (including all addenda issued prior to receipt of bids).

Bidding Requirements. The advertisement or invitation to bid, instructions to bidders, bid security form, if any, and the bid form with any supplements.

Bonds. Bid performance and payment bonds and other instruments of security.

Change Order. A document requested by Contractor and approved by Owner authorizing an addition, deletion, or revision in the Work or an adjustment in the contract price or the contract time, issued on or after the effective date of the Contract.

Claim. A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Time, or both, or other relief with respect to the terms of the contract. A demand for money or services by a third party is not a claim.

Contract. The entire and integrated written contract between Owner and Contractor concerning the Work. The contract supersedes prior negotiations, representations, or agreements, whether written or oral.

Contract Documents. The Contract Documents establish the rights and obligations of the parties and include the Contract, addenda (pertaining to the Contract Documents), contractor's bid (including documentation accompanying the bid and any post-bid documentation submitted prior to the notice of award) when attached as an exhibit to the Contract, the Notice to Proceed, the bonds, these general terms and conditions, the supplementary terms and conditions (if any), the specifications and the drawings as the same are more specifically identified in the Contract, together with all written amendments, change orders, and field orders written issued on or after the effective date of the Contract. Shop Drawings, Product Data, Samples, and other submittals from Contractor do not constitute Contract Documents. Their purpose is merely to demonstrate the manner in which Contractor intends to implement any work in conformance with information received from the Contract Documents.

Contract Price. The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Contract (subject to the provisions relating to unit price work, if applicable).

Contract Time. The number of calendar days or the dates stated in the Contract to: (i) achieve Substantial Completion; and (ii) complete the work so that it is ready for final payment pursuant to written recommendation of final payment.

Contractor. The individual or business entity with whom Owner has entered into a Contract.

Drawings. That part of the Contract Documents prepared or approved by Owner that graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop drawings and other Contractor submittals are not drawings as defined herein.

Field Order. A written order issued by Owner that requires minor changes in the Work by which does not involve a change in the Contract Price or the Contract Time.

Final Completion. The date when all the Work outstanding at Substantial Completion (punch list or defects list) has been completed.

Liens. Charges, security interests, or encumbrances upon project funds, real property, or personal property.

Owner. This term shall be construed to mean, when referencing an individual, the New Hanover County Airport Authority Project Manager, or his designee.

Notice to Proceed. A written notice given by Owner to Contractor fixing the date on which the Contract Time (including milestones, if applicable) will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

Project. The total construction of and the Work to be performed under the Contract Documents.

Samples. Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

Schedule of Values. A listing of elements, systems, items, or other subdivisions of the Work, establishing a value for each, the total of which equals the contract sum. The schedule of values is used for establishing the cash flow of a project.

Shop Drawings. All drawings, diagrams, illustrations, schedules, or other data or information that are specifically prepared or assembled by Contractor to illustrate some portion of the Work.

Site. Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

Specifications. That part of the Contract Documents consisting of written technical descriptions of materials, equipment, systems, standards, and workmanship as applied to the Work and certain administrative details applicable thereto.

Stoppage. Any willful suspension of the Work on the Project by Contractor for an uninterrupted period of seven (7) business days for any reason not requested by Owner and not caused by conditions created by natural phenomena or acts of God.

Subcontractor. An individual or entity having a direct contract with Contractor or with any other subcontractor for the performance of a part of the Work at the site.

Substantial Completion. The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Owner, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended and the building(s) have functional electric, plumbing, HVAC, are fully compliant with applicable building codes, are clean, able to accommodate furnishings, and open for business such that Owner received beneficial occupancy. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to substantial completion thereof.

Unit Price Work. Work to be paid for based on unit prices.

The Work. The entire completed construction or the various separately identifiable parts thereof required to be provided by the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and

equipment into such construction, all as required by the Contract Documents.

ARTICLE I
GENERAL PROVISIONS

1.1 Performance. Contractor shall furnish all labor, materials and equipment and shall perform all Work as defined herein in the manner and form as provided by the specifications and Contract Documents, which are made a part hereof as if fully contained herein:

Notice to Bidders, Bid Proposal, General Conditions, Special Provisions, Drawings and Specifications with Attached Miscellaneous Provisions, and Insurance Certificates for Workers' Compensation, Public Liability and Property Damage, for the Project more fully described therein and generally described as: **Wilmington Terminal Improvements Contract 2**. **The Contract shall be for the Base Bid (and Owner Selected Alternates), total bid amount $_____.**

Contract Summary	
Base Bid	**$**
(Owner Selected Alternates)	**$**
Contract Amount	**$**

1.2 No Privity with Others. Nothing contained in this Contract shall create, or be interpreted to create, privity, or any other contractual agreement between Owner and any person or entity other than Contractor.

1.3 Successors and Assigns. Owner and Contractor bind themselves, their successors, assigns, and legal representatives to the other party hereto and to successors, assigns and legal representatives of such other party with respect to covenants, agreements, and obligations contained in this Contract. Contractor shall not assign this Contract without written consent of Owner and any surety to this Contract.

1.4 Continuing Duty. Contractor shall have a continuing duty to read, carefully examine, and compare each of the Contract Documents, the Shop Drawings and the Project Data and shall provide written notice to Owner of any inconsistency, ambiguity, error, or omission which Contractor may discover with respect to these documents before proceeding with the affected Work. The issuance or the express or implied approval by Owner or the Consulting/Design Engineer of the Contract Documents, Shop Drawings, Plans, Project Data, Product Data, or Samples shall not relieve Contractor of its continuing duties imposed hereby, nor shall any approval be evidence of Contractor's compliance with this contract. OWNER MAKES NO REPRESENTATION OR WARRANTY OF ANY NATURE WHATSOEVER TO CONTRACTOR CONCERNING THE ACCURACY OR SUFFICIENCY OF SUCH

DOCUMENTS. By the execution of the Contract, Contractor acknowledges and represents that it has received, reviewed, and carefully examined such documents, has found them to be complete, accurate, adequate, consistent, coordinated and sufficient to perform the Work, and that Contractor has not, does not, and will not rely upon any representation or warranties by Owner concerning such documents as no such representation or warranties have been or are hereby made.

1.5 Neither the organization of any of the Contract Documents into divisions, sections, paragraphs, articles, (or other categories), nor the organization or arrangement of the design, shall control Contractor in determining the scope of the Work to be performed, or dividing the Work or in establishing the extent or scope of the Work to be performed by Subcontractors.

1.6 Ownership of Contract Documents. The Contract Documents shall remain the property of Owner. Contractor shall have the right to keep one record set of the Contract Documents upon completion of the Project; provided, however, that in no event shall Contractor use, or permit to be used, any Contract Documents on other projects without Owner's prior written authorization.

1.7 The Work. Contractor shall perform all of the work required, implied, or reasonably inferable from this Contract.

1.8 Independent Contractor. It is mutually understood and agreed that Contractor is an independent contractor and not an agent of Owner, and as such, Contractor, its agents and employees shall not be entitled to any Owner employment benefits, such as, but not limited to, vacation, sick leave, insurance, worker's compensation, pension, or retirement benefits.

ARTICLE II
TIME AND LIQUIDATED DAMAGES

2.1 Contract Time. Contractor shall commence the Work upon receipt of a Notice to Proceed and shall achieve Substantial Completion of the Work as follows:

Total Project Completion Time	450 Calendar Days
Interim Milestone Completion for Building Completion and Occupation of new ATO Offices	270 Calendar Days from NTP

Work in areas occupied by TSA, Airport, and/or Airlines shall be performed after operating hours.

2.2 Substantial Completion Liquidated Damages. Contractor shall pay Owner the sum of One Thousand ($1,000.00) Dollars per day for each and every calendar day of unexcused delay in achieving Substantial Completion. Any sums due and payable hereunder by Contractor shall be payable, not as a penalty, but as liquidated damages representing an estimate of delay damages likely to be sustained by Owner, estimated at

or before the date of executing this Contract. Liquidated damages are used in this Agreement because time is of the essence. Any ensuring loss suffered by Owner for delay is not readily ascertainable as of the date of contract execution. Contractor agrees and recognizes that any delay to Substantial Completion shall constitute a material breach. When Owner reasonably believes that Substantial Completion will be inexcusably delayed, Owner shall be entitled to withhold from any amounts due Contractor an amount determined by Owner to be adequate to recover liquidated damages attributable to such delays. If or when Contractor remedies the delay in achieving Substantial Completion, or any part thereof, for which Owner has withheld payment, Owner shall promptly release to Contractor all or a portion of those funds withheld as liquidated damages.

2.3 Term of Contract. Contractor shall commence the Work upon Notice to Proceed. Final Completion, including any punch list, shall be achieved within 30 days from Substantial Completion.

ARTICLE III
CONTRACT CHANGES

3.1 Changes Permitted. Changes in the Work within the general scope of this Contract, consisting of additions, deletions, revisions, or any combination thereof, may be ordered by Change Order or Field Order without invalidating the Contract.

3.2 Changes in the Work shall be performed under applicable provisions of this Contract, and Contractor shall proceed promptly with such changes.

3.3 Changes in the Contract Price. Any change in the Contract Price resulting from a Change Order shall be determined as follows: (a) by mutual agreement between Owner and Contractor as evidenced by (1) the change in the Contract Price, together with any conditions or requirements related thereto, being initialed by both parties and (2) Contractor's execution of the Change Order.

3.4 Unit Price. If unit prices are provided in the Contract, and if the quantities contemplated are so changed in a proposed Change Order that application of such unit prices to the quantities of work proposed would cause substantial inequity to Owner or to Contractor, the applicable unit prices shall be equitably adjusted.

3.5 Effect of Executed Change Order. The execution of a Change Order by Contractor shall constitute conclusive evidence of Contractor's agreement to the ordered changes in the Work, the Contract Price, and the Contract Time. Contractor, by executing the Change Order, waives and forever releases any claim against Owner for additional time or compensation for matters relating to, arising out of, or resulting from the Work included within or affected by the executed Change Order.

3.6 Notification of Surety. Contractor shall provide surety bonds whereby the Surety waives notice of any change, including changes of time, to the Contract.

ARTICLE IV
CONTRACT PRICE AND COMPLETION

4.1 The Contract Price. Owner shall pay, and Contractor shall accept, as full and complete payment for all of the Work required herein, _____ **($_____) Dollars**. The sum shall constitute the maximum Contract Price, which shall not be modified except by Change Order.

4.2 Schedule of Values. Within ten (10) calendar days of Contract execution, Contractor shall submit to Owner a Schedule of Values allocating the Contract Price to the various portions of the Work. Contractor's Schedule of Values shall be prepared in a format and supported with data sufficient to allow Owner to substantiate its accuracy. Contractor shall not imbalance its Schedule of Values nor artificially inflate any element thereof. The violation of this provision by Contractor shall constitute a material breach of this Contract. The Schedule of Values shall be used only as a basis for Contractor's Applications for Payment and must be approved in writing by Owner.

4.3 Payment Procedure. Owner shall pay the Contract Price to Contractor as provided below.

4.3 Progress Payments. Based upon Contractor's Applications for Payment approved by Owner, Owner shall make appropriate progress payments to Contractor toward the Contract Price.

4.4 Retainage. To ensure proper performance of the Contract, Owner will retain five percent (5%) of the amount of each approved Pay Application until the Project is 50% complete provided that Contractor continues to perform satisfactorily and any non-conforming work identified in writing prior to that date has been corrected by Contractor and accepted by Owner. If Owner determines Contractor’s performance is unsatisfactory, Owner may reinstate retainage in the amount of five percent (5%) for each subsequent periodic Pay Application until Contractor’s performance becomes satisfactory. The Project shall be deemed fifty percent (50%) complete when Contractor’s gross Project invoices, excluding the value of materials and fixtures stored off-site, equal or exceed fifty percent (50%) of the value of the contract. The value of materials and fixtures stored on-site shall not exceed twenty percent (20%) of Contractor’s gross project invoices for determining whether the Project is fifty percent (50%) complete. Upon fifty percent (50%) completion of the Project, Owner may also withhold additional retainage from any subsequent periodic payments, not to exceed five percent (5%), to allow Owner to retain two and one half percent (2 ½%) total retainage through the completion of the Project. Within sixty (60) days after the submission of a final pay request, Owner, with written consent of the Surety, shall release to Contractor all retainage on payments held by Owner if (1) Owner receives a certificate of Substantial Completion from Contractor, Engineer, or Designer in charge of the Project; or (2) Owner may release all retainage, less that sum Owner reasonably estimates necessary to complete all punch lists, when

Owner the use of the Project that is substantially complete. In all situations, Owner may retain sufficient funds to secure completion of the Project or corrections on any work. If Owner retains funds, the amount retained shall not exceed two and one half times (2 ½) the estimated value of the work to be completed or corrected. Any reduction in the amount of the retainage on payments shall be with the consent of Contractor's surety. Retainer provisions contained within Contractor's subcontracts may not exceed the terms and conditions for retainage provided herein. Contractor is further required to satisfy the retainage provisions of N.C.G.S. 143-134.1(b)(2) with regard to subcontracts for early finishing trades (structural steel, piling, caisson and demolition) and to coordinate the release of retainage for such trades from the retainage held from Contractor by Owner. Nothing shall prevent Owner from withholding payment to Contractor in addition to the amounts identified herein for unsatisfactory job progress, defective construction, or remedied, disputed work or third-party claims filed against Owner or reasonable evidence that a third-party claim will be filed. Payment for stored materials and fixtures shall be conditioned upon Contractor's satisfactory proof to Owner that Owner has title to such materials and fixtures and shall include proof of required insurance. Such Application for Payment shall be signed by Contractor and shall constitute Contractor's representation that the Work has progressed to the level for which payment is requested in accordance with the Schedule of Values, that the Work has been properly installed or performed in full accordance with this Contract, and that Contractor knows of no reason why payment should not be made as requested. Thereafter, Owner will review the Application for Payment and may review the Work at the Project site or elsewhere to determine whether the quantity and quality of the Work is as represented in the Application for Payment and is as required by this Contract. Owner shall determine the amount properly owed to Contractor. Owner shall make partial payments of the Contract Price to Contractor within thirty (30) days following Owner's receipt of each Application for Payment. The amount of each partial payment shall be the amount certified for payment by Owner less such amounts, if any, otherwise owed by Contractor to Owner or which Owner shall have the right to withhold as authorized by this Contract.

4.5 Warranty of Title. Contractor warrants that title to all work covered by an Application for Payment will pass to Owner no later than at the time of the last payment to Contractor. Contractor further warrants that upon submittal of an Application for Payment, all work for which payments have been received from Owner shall be free and clear of liens, claims, security interests, or other encumbrances in favor of Contractor or any other person or entity.

4.6 Subcontractor Payments. Contractor shall promptly pay each subcontractor out of the amount paid to Contractor for such subcontractor's work, the amount to which such subcontractor is entitled. In the event Owner becomes informed that Contractor has not paid a subcontractor as herein provided, Owner shall have the right, but not the duty, to issue future payments to Contractor and or subcontractor as

joint payees. Such joint payment procedure shall create no rights in favor of any person or entity beyond the right of the named payees to payment of the check and shall not be deemed to create any rights in favor of Contractor or subcontractors or to commit Owner to repeat such payments in the future.

4.7 Acceptance Not Implied. No progress payment, nor any use or occupancy of the Project by Owner shall be interpreted to constitute a final acceptance of any Work that is not in full compliance with this Contract.

4.8 Withheld Payment. Owner may decline to make payment, may withhold funds, and, if necessary, may demand the return of some or all of the amounts previously paid to Contractor, to protect Owner from loss due to:

a) defective Work not remedied by Contractor nor, in the opinion of Owner, likely to be remedied by Contractor;

b) claims of third parties against Owner or Owner's property;

c) failure by Contractor to pay subcontractors;

d) evidence that the balance of the Work cannot be completed in accordance with the Contract for the unpaid balance of the Contract price;

e) evidence that the Work will not be completed in the time required for Substantial or Final Completion;

f) persistent failure to carry out the Work in accordance with the Contract;

g) damage to Owner or a third party to whom Owner is, or may be, liable.

In the event that Owner makes written demand upon Contractor for amounts previously paid by Owner as contemplated in this subparagraph, Contractor shall comply within thirty (30) business days of receipt of written demand.

4.9 Completion and Final Payment. When Contractor certifies that the Work is finally complete, Contractor shall submit to the Owner a list of items completed or corrected. When the Owner determines that the Work is finally complete, a Certificate of Final Completion will be prepared establishing the date of Final Completion. If the Work is complete in full accordance with this Contract and this Contract has been fully performed, Owner may proceed with payment. Any guarantees or warranties, express or implied, required by the Contract or arising under law shall commence on the date of Final Completion of the Work. The Certificate of Final Completion shall be submitted to Owner and Contractor for their written acceptance of the responsibilities assigned to them in such certificate.

4.10 Final Payment Submittals. Contractor shall not be entitled to final payment unless and until it submits to Owner its affidavit that all payrolls, invoices for materials and equipment, and other liabilities connected with the Work have been fully paid, that releases and waivers of lien are executed by subcontractors, and the consent of Surety has been obtained. If any third party fails or refuses to provide a release of claim or waiver of lien as required by Owner, Contractor shall furnish either a bond or monies satisfactory to Owner to discharge any such lien or indemnify Owner from liability.

4.11 Final Payment Due. Owner shall make final payment of all sums due Contractor within ten (10) business days of Owner's execution of a final Certificate for Payment.

4.12 Contractor Waiver. Acceptance of final payment shall constitute a waiver of all claims against Owner by Contractor except for documented Contractor's request for final payment.

ARTICLE V
OWNER RIGHTS AND DUTIES

5.1 Information Provided by Owner. Owner shall deliver to Contractor, at the time of executing this Contract, available written and tangible materials in its possession concerning conditions below ground at the Project site. Owner does not represent, warrant, or guarantee the accuracy of the information either in whole, or in part, implicitly, or explicitly and shall have no liability for the accuracy of information.

5.2 Excluding permits and fees normally the responsibility of Contractor, Owner shall obtain all approvals, easements, and the like required for construction and shall pay for necessary assessments and charges required for construction, use, or occupancy of permanent structures or for permanent changes in existing facilities.

5.3 Right to Stop Work. If Contractor persistently fails or refuses to perform the Work in accordance with this Contract, Owner may order Contractor to stop the Work immediately.

5.4 Owner's Right to Perform Work. If Contractor's work is stopped by Owner, and Contractor fails within seven (7) business days of such stoppage to provide adequate assurance to Owner that the cause of such stoppage will be eliminated or corrected, then Owner may, without prejudice to any other rights or remedies Owner may have against Contractor, proceed to perform the Work. Owner shall issue an appropriate Change Order deducting from the Contract Price the cost of correcting the deficiencies. If the unpaid portion of the Contract Price is insufficient to cover the amount due Owner, Contractor shall pay the difference to Owner within thirty (30) business days.

5.5 Owner's Right to Correct Defects. Owner shall give Contractor reasonably prompt notice of all observable defects. If Contractor fails to perform corrective work within a time determined by Owner, Owner may perform such work and charge Contractor for the costs incurred.

5.6 No Waiver of Owner's Legal Rights. Upon completion of the Work, Owner will promptly make final inspection and notify Contractor of final acceptance. However, final acceptance shall not preclude or estop Owner from correcting any measurement, estimate, or certificate made before or after completion of the Work, nor shall Owner be precluded or estopped from recovering overpayments from Contractor, or

its surety, or both. A waiver on the part of Owner of any breach of any part of the Contract shall not be held to be a waiver of any other or subsequent breach.

5.7 Owner May Accept Defective or Nonconforming Work. Owner may choose to accept defective or nonconforming Work. In such event, the Contract Price shall be reduced by the greater of (a) the reasonable cost of removing and correcting the defective or nonconforming Work, and (b) the difference between the fair market value of the Project as constructed and the fair market value of the Project had it not been constructed in such a manner as to include defective or nonconforming Work. If the remaining portion of the unpaid Contract Price, if any, is insufficient to compensate Owner for its acceptance of defective or nonconforming Work, Contractor shall, upon written demand from Owner, pay Owner such remaining compensation for accepting defective or nonconforming Work within thirty (30) business days.

ARTICLE VI
CONTRACTOR DUTIES

6.1 Consistent with Contractor's continuing duty set forth in Article I, Contractor shall perform no part of the Work at any time without adequate Contract Documents or, as appropriate, approved Shop Drawings, Product Data, or Samples for such portion of the Work. If Contractor performs any of the Work knowing it involves a recognized error, inconsistency, or omission in the Contract Documents without such notice to Owner, Contractor shall bear responsibility for such performance and shall bear the cost of correction.

6.2 Contractor shall supervise and direct the Work using Contractor's best skill, effort, and attention. Contractor shall be responsible to Owner for all acts or omissions of Contractor, its employees, subcontractors, and others engaged in the Work on behalf of Contractor.

6.3 Warranty. Contractor warrants to Owner that all labor furnished to progress the Work under this Contract will be competent to perform the tasks to meet the standards of workmanlike quality prevailing in North Carolina, that materials and equipment furnished will be of good quality, new, free from faults and defects, and in strict conformance with this Contract. All Work not conforming to these requirements may be considered defective. Contractor shall be responsible for all costs, damages and expenses including, but not limited to, penalties, fines and fees that Owner may incur because of Contractor’s failure to perform under this Contract.

6.4 Supervision. Contractor shall employ and maintain competent supervisory personnel at the Project site. Absent written instruction from Contractor to the contrary, Contractor’s designated superintendent shall be deemed Contractor's authorized representative at the site and shall be authorized to accept all communications from Owner.

Key supervisory personnel assigned by the Contractor, within ten (10) to this Project are as follows:

NAME FUNCTION

_____

_____

_____

So long as the individuals named above remain actively employed or retained by the Contractor, they shall perform the functions indicated next to their names unless the Authority agrees to the contrary in writing. In the event one or more individuals not listed above subsequently assume one or more of those functions listed above, the Contractor shall be bound by the provisions of the above Subparagraph as though such individuals had been listed above.

6.5 Time of Performance Schedule. Contractor, within ten (10) days of award of Contract, shall submit to Owner, Contractor's schedule for completing the Work. Contractor's schedule shall be revised no less frequently than monthly, and updated with each Pay Application, and the Schedule shall be revised to reflect unexpected conditions or occurrences related to the entire Project. Document revisions shall be furnished to Owner for approval. Failure by Contractor to comply strictly with the provisions of this Paragraph shall constitute a material breach of this Contract.

6.6 Contractor shall continuously maintain at the site, for the benefit of Owner, one copy of this Contract marked to record on a current basis changes, selections, and modifications made during construction. Additionally, Contractor shall maintain at the site the approved Shop Drawings, Product Data, Samples, and other similar required submittals. Upon Final Completion of the Work, all record documents shall be delivered to Owner.

6.7 Contractor shall not perform any portion of the Work requiring submittal and review of Shop Drawings, Product Data, or Samples unless and until Owner shall have approved the documents. Approval by Owner, however, shall not be evidence that the Work installed pursuant thereto conforms to the requirements of this Contract.

6.8 Cleaning the Site and the Project. Contractor shall keep the site clean during performance of the Work. Upon Final Completion of the Work, Contractor shall clean the site and the Project and remove all waste, together with all of Contractor's property.

6.9 Access to Work. Owner shall have access to the Work at all times from commencement of the Work through Final Completion. Contractor shall provide access to Owner when requested.

6.10 Permits and Licenses. Contractor shall procure all applicable permits and licenses, including permits and licenses required pursuant to applicable patent and copyright laws, shall pay all charges and fees, and shall give all notices necessary and incidental to the due and lawful prosecution to the work. There will be no charge for County building permits.

6.11 Indemnity. To the fullest extent permitted by law, Contractor shall indemnify and hold harmless Owner, its officers, officials, agents and employees from and against liability, claims, damages, losses and expenses, including attorneys' fees, arising out of or resulting from performance of the Work, provided that such liability, claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of Contractor, anyone directly or indirectly employed by it or anyone for whose acts they may be liable, regardless of whether or not such liability, claim, damage, loss or expense is caused in part by Owner, its officers, officials, agents and employees.

ARTICLE VII
INSURANCE

7.1 Commercial General Liability. Contractor shall maintain Commercial General Liability (CGL) with a total limit of not less than $5,000,000 each occurrence for bodily injury and property damage. If such CGL insurance contains a general aggregate limit, it shall apply separately to the Project or the general aggregate shall be twice the required limit. CGL insurance shall be written on Insurance Services Office (ISO) “occurrence” form CG 00 01 covering CGL or its equivalent and shall cover the liability arising from premises, operations, independent contractors, products-completed operations, personal and advertising injury, and liability assumed under an insured contract, including the tort liability of another assumed in a business contract.

Owner, its officers, officials, agents, and employees are to be covered as additional insureds under the CGL by endorsement CG 20 10 and CG 20 37 or an endorsement providing equivalent coverage with respect to liability arising out of activities performed by or on behalf of Contractor; products and completed operations of Contractor; premises owned, leased or used by Contractor; and under the commercial umbrella, if required by Owner. The coverage shall contain no special limitations on the scope of protection afforded to Owner, its officers, officials, agents, and employees. The status of Owner as an additional insured under a CGL obtained in compliance with this

Contract shall not restrict coverage under such CGL with respect to the escape or release of pollutants at or from the Project site. There shall be no endorsement or modification of the CGL or Umbrella Liability limiting the scope of coverage for liability arising from pollution, explosion, collapse, underground property damage, employment-related practices, or damage to the named insured's work. Contractor shall maintain CGL and, if necessary Commercial Umbrella Liability (CUL) insurance, both applicable to liability arising out of Contractor's completed operations, with a limit of not less than $5,000,000 each occurrence for at least three (3) years following substantial completion of the Work. Contractor's CGL insurance shall be primary as to Owner, its officers, officials, agents, and employees. Any other insurance or self-insurance maintained by Owner, its officers, officials, agents, and employees shall be excess of and not contribute toward Contractor's insurance.

7.2 The Workers' Compensation and Employer's Liability. Contractor shall maintain Workers' Compensation as required by the State of North Carolina and Employer's Liability Insurance. The Employer's Liability, and if necessary, CUL insurance shall not be less than $5,000,000 each accident for bodily injury by accident, $5,000,000 each employee for bodily injury by disease, and $5,000,000 policy limit. The Insurer shall agree to waive all rights of subrogation against Owner, its officers, officials, agents, and employees for losses arising from the Work performed by Contractor for Owner.

7.3 Business Auto Liability. Contractor shall maintain Business Auto Liability and, if necessary, CUL insurance with a limit of not less than $5,000,000 combined single limit. Such insurance shall cover liability arising out of any auto, including owned, hired, and non-owned autos. Business Auto coverage shall be written on ISO form CA 00 01, or a substitute form providing equivalent liability coverage. If necessary, the policy shall be endorsed to provide contractual liability coverage equivalent to that provided in ISO form CA 00 01. Contractor's Business Auto Liability insurance shall be primary as to Owner, its officers, officials, agents, and employees. Any other insurance or self-insurance maintained by Owner, its officers, officials, agents, and employees shall be excess of and not contribute with Contractor's insurance.

7.4 Builders Risk Insurance. Contractor shall purchase and maintain in force builders risk insurance on the entire work. Such insurance shall be written on a completed value form and in an amount equal to the initial contract sum subject to subsequent modifications of the contract sum. The insurance shall apply on a replacement cost basis. Builders Risk insurance shall name as insureds Owner, Contractor, and all subcontractors and sub-subcontractors. Builders Risk insurance shall cover the entire work at the site identified in this Contract including reasonable compensation for architects' services and expenses made necessary by an insured loss. Insured property shall include portions of work located away from the site but intended for use at the site, and shall also cover portions of the work in transit. The policy shall cover the cost of removing debris, including demolition as may be made legally necessary

by the operation of any law, ordinance, or regulation. Builders Risk Insurance shall, at a minimum, cover the perils insured under the ISO special causes of loss form (CP 10 30) and shall be endorsed as needed to provide full coverage for loss or damage from collapse including collapse resulting from design error.

Builders Risk Insurance shall include coverage for flood. If property is damaged by the failure of Contractor to maintain Builders Risk or Equipment Breakdown, then Contractor shall bear all reasonable costs properly attributable to that failure.

Partial occupancy or use of the Work upon substantial completion shall not commence until the insurance company or companies providing Builders Risk insurance have consented to such partial occupancy or use. Owner and Contractor shall take reasonable steps to obtain consent of the insurance company or companies, and agree to take no action, other than upon mutual written consent, with respect to occupancy or use of the Work that could lead to cancellation, lapse, or reduction of insurance.

7.5 Surety Bond - Performance & Payment Bonds. Contractor shall furnish and deliver to Owner a Payment Bond and a Performance Bond covering the faithful performance and completion of work included in this Contract and payment for all materials and labor furnished or supplied in connection with work included in this Contract. All bonds shall be issued and furnished to Owner prior to, and as a condition precedent to, commencement of the Work of this Contract. The Payment Bond and Performance Bond shall be furnished on behalf of Contractor, shall name Owner obligee, and shall be one hundred percent (100%) of the amount of the guaranteed repair and maintenance costs. Such bond(s) shall be solely for the protection of Owner. The Payment Bond and the Performance Bond shall be issued by a surety of financial standing having a rating from A.M. Best Company equal to or better than A and must be included on the approved list of sureties issued by the United States Department of Treasury. The bond shall remain in effect at least one (1) year after the date when final payment is made. The surety bond must be in the form set forth in N.C.G.S. 44A-33, without any variations therefrom. Contractor shall provide surety bond wherein Surety waives notice of all modifications, omissions, additions, changes and advance payments or deferred payments in or about the Contract, and agrees that the obligations undertaken by the Bond shall not be impaired in any manner due to any modifications, omissions, additions, changes, and advance payments or deferred payments. The surety bond must set forth no requirement that suit be initiated prior to the time stipulated in applicable North Carolina Statutes of Limitation.

7.6 Deductibles and Self-Insured Retentions. Contractor shall be solely responsible for the payment of all deductibles to which such policies are subject, whether or not Owner is an insured under the policy.

7.7 Miscellaneous Insurance Provisions: Any failure to comply with reporting provisions of the policies listed in this Contract shall not affect coverage provided to Owner, its officers, officials, agents, and employees. Each insurance policy

required by this contract shall be endorsed to state that coverage shall not be canceled by either party except after thirty (30) days prior written notice has been given to New Hanover Risk Management, 230 Government Center Drive, Ste. 125, Wilmington, North Carolina, 28403.

If Contractor's liability policies do not contain the standard ISO separation of insureds provision, or a substantially similar clause, they shall be endorsed to provide cross-liability coverage.

7.8 Acceptability of Insurers. Insurance is to be placed with insurers licensed to do business in the State of North Carolina with an A.M. Best's rating of no less than A VII unless specific approval has been granted by Owner.

7.9 Evidence of Insurance. Contractor shall furnish Owner with a certificate(s) of insurance, executed by a duly authorized representative of each insurer, showing compliance with the insurance requirements prior to commencing the Work, and thereafter upon renewal or replacement of each certified coverage until all the Work under this contract are deemed complete. Evidence of additional insured status shall be noted on the certificate of insurance as per requirements in this Contract. Insurance maintained after final payment evidencing such coverage shall be provided to Owner with final application for payment and thereafter upon renewal or replacement of such insurance until the expiration of the two-year period for which such insurance must be maintained.

7.10 Subcontractors. Contractor shall include all subcontractors as insureds under its policies or shall furnish separate certificates for each subcontractor. All coverage for subcontractors shall be subject to all of the requirements stated herein. CCL coverage shall include Independent Contractors' coverage, and Contractor shall be responsible for assuring that all subcontractors are properly insured.

7.11 Conditions. Owner may, at its discretion and with the approval of Risk Management and the Finance Department, accept letters of credit or custodial accounts in lieu of specific insurance requirements. Contractor shall warrant that the insurance contributing to the satisfaction of insurance requirements in this Contract and shall not be canceled, terminated, or modified by Contractor without prior written approval of Owner. Contractor shall promptly notify the New Hanover County Airport Authority of any accidents arising in the course of operations under the Contract causing bodily injury or property damage. Owner reserves the right to obtain complete, certified copies of all required insurance policies. Failure of Owner to demand a certificate of insurance or other evidence of full compliance with these insurance requirements or failure of Owner to identify a deficiency from evidence that is provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance. Owner does not represent that coverage and limits will be adequate to protect Contractor and such coverage and limits shall not be deemed as a limitation of Contractor's liability under the indemnities granted to Owner in this Contract. If Contractor fails to maintain the insurance as set forth herein, Owner shall have the right to purchase said insurance at Contractor's expense.

Contractor agrees to reimburse Owner for all expenses incurred for such purchase. Contractor or its agent may apply to Owner for approval of higher deductibles based on financial capacity and quality of the carrier affording coverage. Owner shall have the right to prohibit Contractor or any subcontractor from performing work or services and may withhold payment until required certificates has been received and approved by Owner.

ARTICLE VIII
CLAIMS

8.1 Claims by Contractor. All Contractor claims shall be initiated by written notice and claim to Owner. Such written notice and claim must be furnished within seven (7) calendar days after occurrence of the event, or the first appearance of the condition, giving rise to the claim.

8.2 Contractor's Duty to Continue Work. Pending final resolution of any claim of Contractor, Contractor shall diligently proceed with performance of this Contract. The resolution of any claim under this Paragraph shall be reflected by a Change Order executed by Owner and Contractor.

8.3 Claims for Concealed and Unknown Conditions. Should concealed and unknown conditions encountered in the performance of the Work (a) below the surface of the ground or (b) in an existing structure be at variance with the conditions indicated by this Contract, or should unknown conditions of an unusual nature differing materially from those ordinarily encountered in the area and generally recognized as inherent in the Work of the character provided for in this Contract be encountered, the Contract Price shall be equitably adjusted by Change Order upon the written notice and claim by either party made within seven (7) calendar days after the first observance of the condition. As a condition precedent to Owner having any liability to Contractor for concealed or unknown conditions, Contractor must give Owner written notice of, and an opportunity to observe, the condition prior to disturbing it. The failure by Contractor to make the written notice and claim as provided in this subparagraph shall constitute a waiver by Contractor of any claim arising out of or relating to such concealed or unknown condition.

8.4 Claims for Additional Costs. If Contractor wishes to make a claim for an increase in the Contract Sum, it shall give Owner written notice thereof within seven (7) calendar days after the occurrence of the event giving rise to such claim. Such notice shall be given by Contractor before proceeding to execute any additional or changed work. The failure by Contractor to give such notice and to give such notice prior to executing the Work shall constitute a waiver of any claim for additional compensation. No such claim shall be valid unless so made.

8.4.1 In connection with any claim by Contractor against Owner for compensation in excess of the Contract Price, any liability of Owner for Contractor's costs

shall be strictly limited to direct costs incurred by Contractor and shall in no event include Contractor's indirect costs or consequential damages. Owner shall not be liable to Contractor for claims of third parties, including subcontractors, unless and until liability of Contractor has been determined in a court of competent jurisdiction.

8.5 Claims for Additional Time. If Contractor is delayed in progressing any task which at the time of the delay is then critical or which during the delay becomes critical, as the sole result of any act or neglect to act by Owner or someone acting in Owner's behalf, or by changes ordered in the Work, unusual delay in transportation, unusually adverse weather conditions not reasonably anticipatable, fire or any causes beyond Contractor's control, then the date for achieving Substantial Completion of the Work shall be extended upon the written notice and claim of Contractor to Owner, for such reasonable time as Owner may determine by written change order. Any notice and claim for an extension of time by Contractor shall be made not more than seven (7) calendar days after the occurrence of the event or the first appearance of the condition giving rise to the claim and shall set forth in detail Contractor's basis for requiring additional time in which to complete the Project. In the event the delay to Contractor is a continuing one, only one notice and claim for additional time shall be necessary. If Contractor fails to make such claim as required in this Subparagraph, any claim for extension of time shall be waived.

8.5.1 If Contractor is delayed in the progress of the Work for any reason, including any act or neglect of Owner, any of its officers, officials, employers or agents, or any separate contractor employed by Owner, an extension of time shall be Contractor's exclusive remedy and Contractor waives any right it may otherwise have to damages because of delays or disruptions of any nature whatsoever to all or any part of the Work including, that this provision in itself shall not preclude Contractor from recovering damages for delays solely by acts of Owner or its officers, officials, agents, or employees.

8.6 Conflict of Interest. No party to this Contract shall acquire or possess any interest, either direct or indirect, in any aspect of the subject property to be constructed or renovated hereunder.

ARTICLE IX
SUBCONTRACTORS

9.1 Subcontractors. A Subcontractor is an entity that has a direct contract with Contractor to perform a portion of the Work.

9.2 Award of Subcontracts. Upon execution of the Contract, Contractor shall furnish Owner, in writing, the names of persons or entities proposed by Contractor to act as a subcontractor on the Project. Owner shall within ten (10) calendar days reply to Contractor, in writing, stating any objections Owner may have to such proposed subcontractor. Contractor shall not enter into a subcontract with a proposed subcontractor

to whom Owner has made timely objection. Contractor shall not be required to subcontract with any party to whom Contractor has objection.

9.2.1 All subcontracts shall afford Contractor rights against the subcontractor, which correspond to those rights afforded to Owner against Contractor herein, including those rights afforded to Owner hereunder by the Subparagraphs captioned “Termination by Owner”.

ARTICLE X
TERMINATION

10.1 Termination by Contractor. If the Work is stopped for a period of ninety (90) days by an order of any court or other public authority, or as a result of an act of the Government, through no fault of Contractor or any person or entity working directly or indirectly for Contractor, Contractor may, upon ten (10) calendar days' written notice to Owner terminate performance under this Contract and recover from Owner payment for the actual reasonable expenditures of Contractor for all Work executed and for materials, equipment, tools, construction equipment and machinery actually purchased or rented solely for the Work, less any salvage value of any such items.

10.1.1 If Owner shall persistently or repeatedly fail to perform any material obligation to Contractor for a period of fifteen (15) calendar days after receiving written notice from Contractor of its intent to terminate, Contractor may terminate performance under this Contract by written notice to Owner. In such event, Contractor shall be entitled to recover from Owner as though Owner had terminated Contractor's performance.

10.2 Termination by Owner For Convenience. Owner may for any reason whatsoever terminate performance under this Contract by Contractor for convenience. Owner shall give written notice of such termination to Contractor specifying when termination becomes effective.

10.2.1 Contractor shall incur no further obligations in connection with the Work and Contractor shall stop Work when such termination becomes effective. Contractor shall also terminate outstanding orders and subcontracts. Contractor shall settle the liabilities and claims arising out of the termination of subcontracts and orders. Owner may direct Contractor to assign Contractor's right, title, and interest under terminated orders or subcontracts to Owner or its designee.

10.2.2 Contractor shall transfer title and deliver to Owner such completed or partially completed Work and materials, equipment, parts, fixtures, information and Contract rights Contractor controls or possesses.

10.2.3 (a) Contractor shall submit a termination claim to Owner specifying the amounts due because of the termination for convenience together with costs, pricing or other data required by Owner. If Contractor fails to file a termination claim within one

(1) year from the effective date of termination, Owner shall pay Contractor, an amount derived in accordance with subparagraph [c] below.

(b) Owner and Contractor may agree to the compensation, if any, due to Contractor.

(c) Absent agreement to the amount due to Contractor, Owner shall pay Contractor the following amounts:

(i) Contract prices for labor, materials, equipment, and other services accepted under this Contract.

(ii) Reasonable costs incurred in preparing to perform and in performing the terminated portion of the Work, and in terminating Contractor's performance, plus a fair and reasonable allowance for overhead and profit thereon (such profit shall not include anticipated profit or consequential damages); provided however, that if it appears that Contractor would have not profited or would have sustained a loss if the entire Contract would have been completed, no profit shall be allowed or included and the amount of compensation shall be reduced to reflect the anticipated rate of loss, if any;

(iii) Reasonable costs of settling and paying claims arising out of the termination of subcontracts or orders pursuant hereto.

10.3 Termination by Owner For Cause. If Contractor persistently or repeatedly refuses or fails to prosecute the Work in a timely and/or competent manner, supply enough properly skilled workers, supervisory personnel or proper equipment or materials, or if it fails to make prompt payment to subcontractors or for materials or labor, or persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or otherwise is guilty of a substantial violation of a material provision of this Contract, then Owner may by written notice to Contractor, without prejudice to any other right or remedy, terminate the employment of Contractor and take possession of the site and of all materials owned by Owner and may finish the Work by whatever methods it may deem expedient. Contractor shall not be entitled to receive any further payment until the Work is finished.

10.3.1 If the unpaid balance of the Contract Price exceeds the cost of finishing the work, including compensation for Owner's additional services and expenses made necessary thereby, such excess shall be paid to Contractor. If such cost exceeds the unpaid balance, Contractor shall pay the difference to Owner. This obligation for payment shall survive the termination of the Contract.

10.3.2 In the event Owner terminates the employment of Contractor for cause and it is subsequently determined by a Court of competent jurisdiction that such termination was without cause, such termination shall thereupon be deemed a Termination for Convenience.

ARTICLE XI
COMPLIANCE WITH LAWS

11.1 Laws To Be Observed. Contractor shall observe and comply with all Federal and State laws, including Department of Labor Health and Safety Regulations, and all local laws, ordinances and regulations, which in any way affect the Work. Contractor shall have the duty to maintain safety on the job site. OSHA or other Federal, State or Local laws, rules or regulations pertaining to safety shall be the sole responsibility of Contractor. Contractor shall indemnify and hold Owner harmless for any safety violations assessed against Owner.

11.2 Underground Damage Prevention. Contractor shall comply with N.C.G.S. Chapter 87, Article 8 and shall be responsible for costs of repair to all utilities damaged during construction.

11.3 Taxes. Contractor shall pay all applicable Federal, State, and Local taxes, including sales taxes on all equipment and materials used on the Project. Owner is qualified to receive all sales taxes paid on the project as a rebate. Contractor shall submit a statement showing the invoice and sales taxes paid to any governmental entity of all materials and equipment used at the Project. A tax statement shall be submitted with each Pay Application and shall be accompanied by an affidavit verifying validation.

11.4 Contractor Non-Discrimination. Contractor will take affirmative action not to discriminate against any employee or applicant for employment or otherwise illegally deny any person participation in or the benefits of the activities that are the subject of this Contract, because of race, creed, color, sex, age, disability, or national origin.

11.5 Goal for Participation by Minority Businesses. It is the policy of Owner that minority businesses shall have the maximum opportunity to participate in the performance of contracts financed with public money including contracts awarded pursuant to the requirements of N.C.G.S Chapter 143, Article 8. Owner has adopted a ten percent (10%) verifiable goal for participation by minority/women/disadvantaged businesses in the total value of work required by the terms and conditions of this Contract. Contractor covenants and agrees to comply with Owner policy the provisions of N.C.G.S. Chapter 143, Article 8, and shall follow Owner guidelines specifying the actions Contractor must take to ensure a good faith effort in the recruitment and selection of minority businesses for participation in this Contract.

11.6 E-Verify Compliance. Pursuant to N.C.G.S. 143-133.3, Contractor shall fully comply with the U.S. Department of Homeland Security employee legal status E-Verify requirements for itself and all its subcontractors. Violation of the provision, unless timely cured, shall constitute a breach of contract.

ARTICLE XII
INTERPRETATION

12.1 Intent and Interpretation. The intent of this Contract is to require complete, correct, and timely execution of the Work. Any work that may be required, implied, or inferred by the Contract Documents, as necessary to produce the intended result shall be provided by Contractor for the contract price.

12.2 Law Applied. All of the terms and conditions contained in the Contract Documents shall be interpreted in accordance with the laws of the State of North Carolina.

12.3 Entire Agreement. This Contract and Contract Documents constitute the entire understanding of the parties. The Contract Documents shall be given precedence in the following order: Agreement, Modifications, Addenda, Supplementary Conditions, Special Conditions, Instructions to Bidders, General Conditions, Specifications, and Drawings.

12.4 Interpretation and Construction. When a word, term, or phrase is used in this Contract, it shall be interpreted or construed first, as defined herein; second, if not defined, according to its generally accepted meaning in the construction industry; and third, if there is no generally accepted meaning in the construction industry, according to its common and customary usage. As between numbers and scaled measurements on the Drawings and in the Design, the numbers shall govern; as between larger scale and smaller scale drawings, the larger scale shall govern.

12.4.1 The words "include," "includes," or "including", as used in this contract, shall be deemed to be followed by the phrase, "without limitation".

12.4.2 Words or terms used as nouns in this Contract shall be inclusive of their singular and plural forms, unless the context of their usage clearly requires a contrary meaning.

12.4.3 The specification herein of any act, failure, refusal, omission, event, occurrence, or condition as constituting a material breach of this contract shall not imply that any other, non-specified act, failure, refusal, omission, event, occurrence, or condition shall be deemed not to constitute a material breach of this Contract.

12.5 Dispute Resolution. Owner hereby adopts those dispute resolutions procedures promulgated by the State Building Commission, as amended from time to time by the Commission or Owner. Said procedures shall be available to address any issues arising out of the contract or construction process wherein the matter in controversy exceeds Fifteen Thousand ($15,000.00) Dollars. Should Contractor herein utilize such dispute resolution procedures it must pay half of all costs incurred by Owner in conducting the dispute resolution.

12.6 Arbitration. Arbitration of claims, disputes, and questions arising under this Contract may only be used when both parties agree to arbitrate. Arbitration

shall be in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association. In no event shall fewer than three (3) arbitrators be used; Owner and Contractor shall each select one (1) arbitrator and the two (2) arbitrators shall select the third. The award rendered by the arbitrators shall be final, specifically enforceable, and recordable as a judgment in any court having jurisdiction.

12.7 Owner Non-Discrimination. Owner covenants and agrees that no person shall be denied benefits of, or otherwise be subjected to discrimination in connection with Owner's performance under this Contract on the grounds of race, religion, color, national origin, sex or handicap.

12.8 Notices. All notices required hereunder to be sent to either party shall be sent to the following designated addresses, or to such other address or addresses as may hereafter be designated by either party by mailing of written notice of such change of address, by Certified Mail, Return Receipt Requested:

To Owner:
New Hanover County Airport Authority
Attn: Granseur Dick
1740 Airport Blvd.
Wilmington, NC 28405

To Contractor:
_____
_____
_____

12.9 Contract Under Seal. The parties hereto expressly agree to create a contract under seal.

IN WITNESS WHEREOF, the parties have affixed their hands and seals and caused the execution of this instrument, by authority duly given and on the day and year first above written.

NEW HANOVER COUNTY AIRPORT AUTHORITY

[SEAL]

_____
Chairman

ATTEST:

_____
Clerk to the Board

CONTRACTOR

[CORPORATE SEAL]

_____
President

ATTEST:

_____
Secretary

This instrument has been pre-audited in the manner required by the Local Government Budget and Fiscal Control Act.

Approved as to form:

_____
Airport Finance Director

_____
County Attorney

STATE OF NORTH CAROLINA

NEW HANOVER COUNTY AIRPORT AUTHORITY

I, _____, a Notary Public of the State and County aforesaid, certify that _____ came before me this day and acknowledged that he is _____ of the New Hanover County Airport Authority, and that by authority duly given and as the act of the Authority, the foregoing instrument was signed in its name by its _____, sealed with its corporate seal and attested by himself as its _____.

WITNESS my hand and official seal, this ____ day of _____, 2018.

_____
Notary Public

My commission expires: _____

STATE OF _____

COUNTY OF _____

I, _____, a Notary Public of the State and County aforesaid, certify that _____, personally came before me this day and acknowledged that (s)he is Secretary of _____, and that by authority duly

given and as the act of the corporation, the foregoing instrument was signed in its name by its President, sealed with its official seal and attested by herself as its Secretary.

WITNESS my hand and official seal, this ____ day of _____, 2018.

_____
Notary Public

My commission expires: _____

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.

1.2 PROJECT INFORMATION

A. Project Identification: ILM Terminal Improvements Contract 2.

B. Owner: New Hanover County Airport Authority, 1740 Airport Boulevard, Suite 12, Wilmington, North Carolina 28405

1. Owner's Representative: Granseur Dick, PE, ILM Planning and Development Director

C. A web-based Project Information Management System administered by Architect will be used for purposes of managing communication and documents during the construction stage.

1. See Section 013100 "Project Management and Coordination" for requirements for using the Project Information Management System.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Furnishing all labor, materials and equipment and performing all work required to satisfactorily complete the project, which consists of phased renovation and expansion of the ticket lobby and airline offices, phased installation of new outbound baggage handling system (BHS) equipment in the Airport’s passenger terminal, and phased demolition of existing BHS equipment. The project also includes mechanical, electrical, plumbing, fire protection, structural and civil work items related to the renovation and expansion of the Ticket Lobby and the BHS installation; and provision of SIDA-badged baggage porters to assist airlines and TSA in baggage handling operations during construction.

B. Type of Contract: Single prime contract.

1.4 PHASED CONSTRUCTION

A. The Work shall be conducted in phases as indicated on Drawings, with each phase substantially complete as indicated.

B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates for all phases of the Work.

1.5 WORK BY OWNER/FUTURE TENANTS

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Subsequent Work: Tenants will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.

1. Tenants will provide residential appliances. Provide infrastructure to support residential appliances as indicated on Drawings.

1.6 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Preceding Work: Owner has awarded separate contract(s) for the following construction operations at Project site. Those operations are scheduled to be substantially complete before Work under this Contract begins.

1. ILM Terminal Improvements - Contract 1.

C. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. Reroofing of the existing airport terminal.
2. ILM Terminal Improvements - Contract 3.
3. Air carrier apron expansion.
4. Installation of new passenger boarding bridges, Gates 2 and 8.

1.7 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

1. Limits: Contractor's use of Project site is limited by:

a. Owner's right to perform work,
b. Owner's right to retain other Contractors on portions of Project,
c. Owner's on-going business.

2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
c. Deliveries which may occur or impact the Owner beyond the limits of the construction site must be scheduled and approved by Owner. Written requests must be submitted a minimum of 14 calendar days prior to the delivery date. The Owner reserves the right to schedule alternative dates in order to mitigate the impact on Owner's on-going activities.

3. Condition of Existing Buildings: Maintain portions of existing buildings affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy adjacent premises during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.9 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
2. Refer to Project Special Provisions included at the end of this Section for restrictions and requirements.

B. E-Verify Compliance: Pursuant to Session Law 2013-418, Contractor shall fully comply with the U.S. Department of Homeland Security employee legal status E-Verify requirements for itself and all its subcontractors. Owner requires an affidavit attesting to Contractor’s compliance. Violation of the provision, unless timely cured, shall constitute a breach of contract.

C. BHS Rights-of-Way: BHS Installer shall have first priorities to the right-of-ways available and/as provided by the appropriate discipline under this contract. Cooperate with other trades for coordination of all building right-of-ways performed by other trades to accommodate the installation of the BHS. Considering the size and magnitude of the BHS scope, the BHS conveyor equipment and associated main conduit/wireway runs (e.g. between the facility power supply sources and BHS motor control panels) shall have first priority to the available right-of-ways within the facility space and as provided by the demolition and clearing of other systems. Coordinate the BHS conveyor equipment and associated main conduit/wireway right-of-ways with all MEP systems right-of-ways that will be installed within the facility to accommodate the specified systems installation.

D. Badging Requirements:

1. Each agency must have a signatory agent on file. Each agent must have a CHRC, STA, receive SIDA and Signatory agent training.
2. The following must be completed before a Purple Badge can be issued.
    a. Must undergo a fingerprint criminal history records check (CHRC)
    b. Must submit to a Security Threat Assessment (STA)
    c. Must take SIDA training
    d. Must have AOA Driver training (Non-Movement Area Driver Training)
3. Employees must have the application signed by an authorized signatory (Owner will provide initial signatory until manager or designee is properly trained) that is in on file with the Public Safety Office. No application will be accepted without the proper signature. Proper I-9 documentation shall be provided with the application. (Need a Driver’s license and SSN Card or just a passport - Copies of these documents will not be accepted.)

4. Individuals applying for a badge must submit to a Security Threat Assessment (STA). Contractor shall call to check the status of the STA. STA's are valid for 30 days, so badge must be issued prior to 30 day expiration.
5. All persons requiring SIDA and/or Sterile Area access must have a fingerprint based Criminal History Records Check (CHRC). Current employees that have already been fingerprinted (within the last 2 years) at another station or at the airline can submit a letter verifying the CHRC is clear. This must be done before they can have SIDA and/or Sterile Area training. CHRC's are valid for 30 days.
6. After the employee has cleared the STA and/or the CHRC, they will need to attend SIDA, Sterile and AOA training. All training is done by appointment only. Please call Rescue Base at 910-341-4336 to schedule a class.
7. Contractor shall pay processing fee.
    a. All ID cards with electronic access privileges - $90 processing fee
    b. Renewals are $25 if renewed prior to the expiration date.
8. See Civil Drawings for additional requirements.

E. On-Site Work Hours: Contractor shall have access to work on the building expansion on a 24-hour basis. Work within the existing building is limited to **8:00 pm - 4:00 am** daily, for work within the ticket lobby area and active baggage screening and handling areas. Coordinate with Owner for additional work hours. Schedule and coordinate Work of this contract with airlines and TSA operations, with airline flight schedules and hours of operation to avoid impacting normal operations and functions.

F. Baggage Porter: Provide baggage porters at Ticket Level and Ramp Level while conveyor equipment is out of service. Baggage porters shall have HAZMAT training and SIDA badge training as required by Owner. Baggage porters shall be capable of heavy lifting and comply with Owner's dress code.

G. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner.

1. Work requiring utility interruptions shall be performed outside of normal business working hours.
2. Notify Owner not less than two days in advance of proposed utility interruptions.
3. Obtain Owner's written permission before proceeding with utility interruptions.

H. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to adjacent occupied areas with Owner.

1. Work activities that may be disruptive to Owner's on-going activities shall be performed outside of normal business working hours.
2. Notify Owner not less than two days in advance of proposed disruptive operations.
3. Obtain Owner's written permission before proceeding with disruptive operations.
4. Comply with requirements of authorities having jurisdiction.

I. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

J. Employee Conduct: Workers shall conduct themselves in a business-like manner at all times.

1. No loud radios will be allowed.
2. No guns or weapons will be allowed.
3. No drugs or alcohol will be allowed.
4. No harassment of any kind, including catcalls, foul language or other offensive language, gestures or other objectionable behavior will be permitted on the site.
5. All employees must wear proper attire at all times. Shirts and shoes are required. T-shirts are acceptable provided they contain no objectionable graphics or text.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

STATE OF _____

E-VERIFY AFFIDAVIT

COUNTY OF _____

****

I, _____(the individual attesting below), being duly authorized by and on behalf of _____ (the entity bidding on project hereinafter "Employer") after first being duly sworn hereby swears or affirms as follows:

1. Employer understands that E-Verify is the federal E-Verify program operated by the United States Department of Homeland Security and other federal agencies, or any successor or equivalent program used to verify the work authorization of newly hired employees pursuant to federal law in accordance with NCGS §64-25(5).

2. Employer understands that Employers Must Use E-Verify. Each employer, after hiring an employee to work in the United States, shall verify the work authorization of the employee through E-Verify in accordance with NCGS§64-26(a).

3. Employer is a person, business entity, or other organization that transacts business in this State and that employs 25 or more employees in this State. (Mark "Yes" or "No")

   a. YES _____

   b. NO _____

4. Employer's subcontractors comply with E-Verify, and if Employer is the winning bidder on this project Employer will ensure compliance with E-Verify by any subcontractors subsequently hired by Employer.

This _____ day of _____, 20____.

_____

Signature of Affiant

Print or Type Name: _____

State of _____ County of _____

Signed and sworn to (or affirmed) before me, this the _____

day of _____, 20____.

My Commission Expires:

_____ _____

Notary Public

(Affix Official/Notarial Seal)

Appendix
Federal Contract Provisions, non-AIP

General

The Contract Provisions contained herein have been developed from the FAA guidance document entitled "Contract Provision Guidelines for Obligated Sponsors and Airport Improvement Program Project," dated June 19, 2018. These provisions shall apply to all work of this contract, and shall apply to all subcontracts and sub-agreements as follows:

1) The contractor and all subcontractors shall insert these contract provisions in each lower tier contract (e.g. subcontract or sub-agreement).
2) The contractor and all subcontractors shall incorporate the applicable requirements of these contract provisions by reference for work done under any purchase orders, rental agreements and other agreements for supplies or services.
3) The prime contractor shall be responsible for compliance with these contract provisions by any subcontractor, lower-tier subcontractor or service provider.

Failure to Comply with Provisions

Contractor failure to comply with the terms of these contract provisions may be sufficient grounds to:

1) Withhold progress payments or final payment;
2) Terminate the contract for cause;
3) Seek suspension/debarment; or
4) Take other action determined to be appropriate by the sponsor or the FAA.

A – CONTRACT PROVISIONS

A1 CIVIL RIGHTS - GENERAL

A1.1 SOURCE

49 USC § 47123

A1.2 CONTRACT CLAUSE

A1.2.1 Sponsor Contracts

GENERAL CIVIL RIGHTS PROVISIONS

The contractor agrees to comply with pertinent statutes, Executive Orders and such rules as are promulgated to ensure that no person shall, on the grounds of race, creed, color, national origin, sex, age, or disability be excluded from participating in any activity conducted with or benefiting from Federal assistance.

This provision binds the contractor and subcontractors from the bid solicitation period through the completion of the contract. This provision is in addition to that required of Title VI of the Civil Rights Act of 1964.

A2 CIVIL RIGHTS – TITLE VI ASSURANCE

A2.1 SOURCE

49 USC § 47123

FAA Order 1400.11

A2.2 CONTRACT CLAUSE

A2.2.1 Title VI Solicitation Notice

Title VI Solicitation Notice:

The **New Hanover County Airport Authority**, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

A2.2.2 Title VI Clauses for Compliance with Nondiscrimination Requirements

Compliance with Nondiscrimination Requirements

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. **Compliance with Regulations:** The contractor (hereinafter includes consultants) will comply with the Title VI List of Pertinent Nondiscrimination Acts And Authorities, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. **Non-discrimination:** The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Nondiscrimination Acts and Authorities, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR part 21.

3. **Solicitations for Subcontracts, Including Procurements of Materials and Equipment:** In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Nondiscrimination Acts And Authorities on the grounds of race, color, or national origin.

4. **Information and Reports:** The contractor will provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be

determined by the sponsor or the Federal Aviation Administration to be pertinent to ascertain compliance with such Nondiscrimination Acts And Authorities and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the sponsor or the Federal Aviation Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. **Sanctions for Noncompliance:** In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the sponsor will impose such contract sanctions as it or the Federal Aviation Administration may determine to be appropriate, including, but not limited to:

    a. Withholding payments to the contractor under the contract until the contractor complies; and/or

    b. Cancelling, terminating, or suspending a contract, in whole or in part.

6. **Incorporation of Provisions:** The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the sponsor or the Federal Aviation Administration may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the sponsor to enter into any litigation to protect the interests of the sponsor. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

A2.2.3 Title VI List of Pertinent Nondiscrimination Acts and Authorities

Title VI List of Pertinent Nondiscrimination Acts and Authorities

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees to comply with the following non-discrimination statutes and authorities; including but not limited to:

- Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d *et seq*., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin);
- 49 CFR part 21 (Non-discrimination In Federally-Assisted Programs of The Department of Transportation—Effectuation of Title VI of The Civil Rights Act of 1964);
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 *et seq*.), as amended, (prohibits discrimination on the basis of disability); and 49 CFR part 27;
- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 *et seq*.), (prohibits discrimination on the basis of age);
- Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);

- The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- Titles II and III of the Americans with Disabilities Act of 1990, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131 – 12189) as implemented by Department of Transportation regulations at 49 CFR parts 37 and 38;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures non-discrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;
- Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

A2.2.4 Title VI Clauses for Deeds Transferring United States Property

This is a rare occurrence, and it will be the responsibility of the United States government to include the clause in the contract. It will be included as a covenant running with the land, in any deed from the United States effecting or recording a transfer of real property, structures, use, or improvements thereon or interest therein to a sponsor.

CLAUSES FOR DEEDS TRANSFERRING UNITED STATES PROPERTY

The following clauses will be included in deeds effecting or recording the transfer of real property, structures, or improvements thereon, or granting interest therein from the United States pursuant to the provisions of the Airport Improvement Program grant assurances.

NOW, THEREFORE, the Federal Aviation Administration as authorized by law and upon the condition that the New Hanover County Airport Authority will accept title to the lands and maintain the project constructed thereon in accordance with (***Name of Appropriate Legislative Authority***), for the **(Airport Improvement Program or other program for which land is transferred),** and the policies and procedures prescribed by the Federal Aviation Administration of the U.S. Department of Transportation in accordance and in compliance with all requirements imposed by Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation pertaining to and effectuating the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252; 42 USC § 2000d to 2000d-4), does hereby remise, release, quitclaim and convey unto the the New Hanover County Airport Authority all the

right, title and interest of the U.S. Department of Transportation/Federal Aviation Administration in and to said lands described in (***Exhibit A attached hereto or other exhibit describing the transferred property)*** and made a part hereof.

(HABENDUM CLAUSE)

TO HAVE AND TO HOLD said lands and interests therein unto the New Hanover County Airport Authority and its successors forever, subject, however, to the covenants, conditions, restrictions and reservations herein contained as follows, which will remain in effect for the period during which the real property or structures are used for a purpose for which Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits and will be binding on the the New Hanover County Airport Authority, its successors and assigns.

The New Hanover County Airport Authority, in consideration of the conveyance of said lands and interests in lands, does hereby covenant and agree as a covenant running with the land for itself, its successors and assigns, that (1) no person will on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination with regard to any facility located wholly or in part on, over, or under such lands hereby conveyed [,] [and]* (2) that the New Hanover County Airport Authority will use the lands and interests in lands and interests in lands so conveyed, in compliance with all requirements imposed by or pursuant to Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Effectuation of Title VI of the Civil Rights Act of 1964, and as said Regulations and Acts may be amended[, and (3) that in the event of breach of any of the above-mentioned nondiscrimination conditions, the Department will have a right to enter or re-enter said lands and facilities on said land, and that above described land and facilities will thereon revert to and vest in and become the absolute property of the Federal Aviation Administration and its assigns as such interest existed prior to this instruction].*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary in order to make clear the purpose of Title VI.)

A2.2.5 Title VI Clauses for Transfer of Real Property Acquired or Improved Under the Activity, Facility, or Program

This applies to agreements such as leases where a physical portion of the airport is transferred for use—for example a fuel farm, apron space, or a parking facility—and will be included as a covenant running with the land, in any future deeds, leases, licenses, permits, or similar instruments entered into by the sponsor with other parties for all transfers of real property acquired or improved under the Airport Improvement Program.

CLAUSES FOR TRANSFER OF REAL PROPERTY ACQUIRED OR IMPROVED UNDER THE AIRPORT IMPROVEMENT PROGRAM

The following clauses will be included in (deeds, licenses, leases, permits, or similar instruments) entered into by the New Hanover County Airport Authority pursuant to the provisions of the Airport Improvement Program grant assurances.

A. The (grantee, lessee, permittee, etc. as appropriate) for himself/herself, his/her heirs, personal representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree [in the case of deeds and leases add "as a covenant running with the land"] that:

1. In the event facilities are constructed, maintained, or otherwise operated on the property described in this (deed, license, lease, permit, etc.) for a purpose for which a Federal Aviation Administration activity, facility, or program is extended or for another purpose involving the provision of similar services or benefits, the (grantee, licensee, lessee, permittee, etc.) will maintain and operate such facilities and services in compliance with all requirements imposed by the Nondiscrimination Acts and Regulations listed in the Pertinent List of Nondiscrimination Authorities (as may be amended) such that no person on the grounds of race, color, or national origin, will be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities.

B. With respect to licenses, leases, permits, etc., in the event of breach of any of the above Nondiscrimination covenants, the New Hanover County Airport Authority will have the right to terminate the (lease, license, permit, etc.) and to enter, re-enter, and repossess said lands and facilities thereon, and hold the same as if the (lease, license, permit, etc.) had never been made or issued.*

C. With respect to a deed, in the event of breach of any of the above Nondiscrimination covenants, the New Hanover County Airport Authority will have the right to enter or re-enter the lands and facilities thereon, and the above described lands and facilities will there upon revert to and vest in and become the absolute property of the New Hanover County Airport Authority and its assigns.*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary to make clear the purpose of Title VI.)

A2.2.6 Title VI Clauses for Construction/Use/Access to Real Property Acquired Under the Activity, Facility or Program

This applies to agreements such as leases of concession space in a terminal and any future deeds, leases, licenses, permits, or similar instruments entered into by the sponsor with other parties for the construction or use of, or access to, space on, over, or under real property acquired or improved under the Airport Improvement Program.

CLAUSES FOR CONSTRUCTION/USE/ACCESS TO REAL PROPERTY ACQUIRED UNDER THE ACTIVITY, FACILITY OR PROGRAM

The following clauses will be included in deeds, licenses, permits, or similar instruments/agreements entered into by the New Hanover County Airport Authority pursuant to the provisions of the Airport Improvement Program grant assurances.

A. The (grantee, licensee, permittee, etc., as appropriate) for himself/herself, his/her heirs, personal representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree (in the case of deeds and leases add, "as a covenant running with the land") that (1) no person on the ground of race, color, or national origin, will be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities, (2) that in the construction of any improvements on, over, or under such land, and the furnishing of services thereon, no person on the ground of race, color, or national origin, will be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination, (3) that the (grantee, licensee, lessee, permittee, etc.) will use the premises in compliance with all other requirements imposed by or pursuant to the List of discrimination Acts And Authorities.

B. With respect to (licenses, leases, permits, etc.), in the event of breach of any of the above nondiscrimination covenants, the New Hanover County Airport Authority will have the right to terminate the (license, permit, etc., as appropriate) and to enter or re-enter and repossess said land and the facilities thereon, and hold the same as if said (license, permit, etc., as appropriate) had never been made or issued.*
C. With respect to deeds, in the event of breach of any of the above nondiscrimination covenants, the New Hanover County Airport Authority will there upon revert to and vest in and become the absolute property of the New Hanover County Airport Authority and its assigns.*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary to make clear the purpose of Title VI.)

A3 FEDERAL FAIR LABOR STANDARDS ACT (FEDERAL MINIMUM WAGE)

A3.1 SOURCE

29 U.S.C. § 201, et seq

A3.2 CONTRACT CLAUSE

All contracts and subcontracts that result from this solicitation incorporate by reference the provisions of 29 CFR part 201, the Federal Fair Labor Standards Act (FLSA), with the same force and effect as if given in full text. The FLSA sets minimum wage, overtime pay, recordkeeping, and child labor standards for full and part time workers.

The *contractor* has full responsibility to monitor compliance to the referenced statute or regulation. The *contractor* must address any claims or disputes that arise from this requirement directly with the U.S. Department of Labor – Wage and Hour Division

A4 OCCUPATIONAL SAFETY AND HEALTH ACT OF 1970

A4.1 SOURCE

20 CFR part 1910

A4.2 CONTRACT CLAUSE

All contracts and subcontracts that result from this solicitation incorporate by reference the requirements of 29 CFR Part 1910 with the same force and effect as if given in full text. Contractor must provide a work environment that is free from recognized hazards that may cause death or serious physical harm to the employee. The Contractor retains full responsibility to monitor its compliance and their subcontractor's compliance with the applicable requirements of the Occupational Safety and Health Act of 1970 (20 CFR Part 1910). Contractor must address any claims or disputes that pertain to a referenced requirement directly with the U.S. Department of Labor – Occupational Safety and Health Administration.

SECTION 10

DEFINITION OF TERMS

Whenever the following terms are used in these specifications, in the contract, or in any documents or other instruments pertaining to construction where these specifications govern, the intent and meaning shall be interpreted as follows:

10-01 **AASHTO**. The American Association of State Highway and Transportation Officials, the successor association to AASHO.

10-02 **Access Road**. The right-of-way, the roadway and all improvements constructed thereon connecting the airport to a public highway.

10-03 **Advertisement**. A public announcement, as required by local law, inviting bids for work to be performed and materials to be furnished.

10-04 **Airport Improvement Program (AIP)**. A grant-in-aid program, administered by the Federal Aviation Administration (FAA).

10-05 **Air Operations Area (AOA)**. For the purpose of these specifications, the term air operations area (AOA) shall mean any area of the airport used or intended to be used for the landing, takeoff, or surface maneuvering of aircraft. An air operation area shall include such paved or unpaved areas that are used or intended to be used for the unobstructed movement of aircraft in addition to its associated runway, taxiway, or apron.

10-06 **Airport**. Airport means an area of land or water which is used or intended to be used for the landing and takeoff of aircraft; an appurtenant area used or intended to be used for airport buildings or other airport facilities or rights of way; and airport buildings and facilities located in any of these areas, and includes a heliport.

10-07 **ASTM International (ASTM)**. Formerly known as the American Society for Testing and Materials (ASTM).

10-08 **Award**. The OWNER's notice to the successful bidder of the acceptance of the submitted bid.

10-09 **Bidder**. Any individual, partnership, firm, or corporation, acting directly or through a duly authorized representative, who submits a proposal for the work contemplated.

10-10 **Building Area**. An area on the airport to be used, considered, or intended to be used for airport buildings or other airport facilities or rights-of-way together

with all airport buildings and facilities located thereon.

10-11 Calendar Day. Every day shown on the calendar.

10-12 Change Order. A written order to the Contractor covering changes in the plans, specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for the work affected by such changes. The work, covered by a change order, must be within the scope of the contract.

10-13 Contract. The written agreement covering the work to be performed. The awarded contract shall include, but is not limited to: Advertisement, Contract Form, Proposal, Performance Bond, Payment Bond, any required insurance certificates, Specifications, Plans, and any addenda issued to bidders.

10-14 Contract Item (Pay Item). A specific unit of work for which a price is provided in the contract, *for which a value is defined in the Contractor's accepted schedule of values, or which is defined within a change order or supplemental agreement.*

10-15 Contract Time. The number of calendar days ~~or working days~~, stated in the proposal, allowed for completion of the contract, including authorized time extensions. ~~If a calendar date of completion is stated in the proposal, in lieu of a number of calendar or working days, the contract shall be completed by that date.~~

10-16 Contractor. The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the work contracted and for the payment of all legal debts pertaining to the work who acts directly or through lawful agents or employees to complete the contract work.

10-17 Contractor's Laboratory. The Contractor's *independent* quality control *laboratory*.

10-18 Construction Safety and Phasing Plan (CSPP). The overall plan for safety and phasing of a construction project developed by the airport operator, or developed by the airport operator's consultant and approved by the airport operator. It is included in the invitation for bids and becomes part of the project specifications.

10-19 Drainage System. The system of pipes, ditches, and structures by which surface or subsurface waters are collected and conducted from the airport area.

10-20 Engineer. The individual, partnership, firm, or corporation duly authorized by the OWNER to be responsible for engineering observation of the contract work and acting directly or through an authorized representative. *The term*

"Engineer" shall mean "Architect".

10-21 **Equipment**. All machinery, together with the necessary supplies for upkeep and maintenance, and also all tools and apparatus necessary for the proper construction and acceptable completion of the work.

10-22 **Extra Work**. An item of work not provided for in the awarded contract as previously modified by change order or supplemental agreement, but which is found by the ENGINEER to be necessary to complete the work within the intended scope of the contract as previously modified.

10-23 **FAA**. The Federal Aviation Administration of the U.S. Department of Transportation. When used to designate a person, FAA shall mean the Administrator or his or her duly authorized representative.

10-24 **Federal Specifications**. The Federal Specifications and Standards, Commercial Item Descriptions, and supplements, amendments, and indices thereto are prepared and issued by the General Services Administration of the Federal Government.

10-25 **Force account.** Force account work is planning, engineering, or construction work done by the Sponsor's employees.

10-26 ~~**Inspector**~~ ***Project Representative***. An authorized representative of the ENGINEER assigned to make all necessary observations and/or observation of tests of the work performed or being performed, or of the materials furnished or being furnished by the Contractor.

10-27 **Intention of Terms**. Whenever, in these specifications or on the plans, the words "directed," "required," "permitted," "ordered," "designated," "prescribed," or words of like import are used, it shall be understood that the direction, requirement, permission, order, designation, or prescription of the ENGINEER is intended; and similarly, the words "approved," "acceptable," "satisfactory," or words of like import, shall mean approved by, or acceptable to, or satisfactory to the ENGINEER, subject in each case to the final determination of the OWNER.

Any reference to a specific requirement of a numbered paragraph of the contract specifications or a cited standard shall be interpreted to include all general requirements of the entire section, specification item, or cited standard that may be pertinent to such specific reference.

10-28 **Laboratory**. ***Deleted.*** ~~The official testing laboratories of the OWNER or such other laboratories as may be designated by the ENGINEER. Also referred to as "ENGINEER's Laboratory" or "quality assurance laboratory."~~

10-29 **Lighting**. A system of fixtures providing or controlling the light sources used on or near the airport or within the airport buildings. The field lighting includes all luminous signals, markers, floodlights, and illuminating devices used on or near the airport or to aid in the operation of aircraft landing at, taking off from, or taxiing on the airport surface.

10-30 **Major and Minor Contract Items**. A major contract item shall be any item ~~that is listed in the proposal~~, the total cost of which is equal to or greater than 20% of the total amount of the awarded contract. All other items shall be considered minor contract items.

10-31 **Materials**. Any substance specified for use in the construction of the contract work.

10-32 **Notice to Proceed (NTP)**. A written notice to the Contractor to begin the actual contract work on a previously agreed to date. If applicable, the Notice to Proceed shall state the date on which the contract time begins.

10-33 **Owner**. The term "OWNER" shall mean the party of the first part or the contracting agency signatory to the contract. Where the term "OWNER" is capitalized in this document, it shall mean airport Sponsor only.

10-34 **Passenger Facility Charge (PFC).** Per 14 CFR Part 158 and 49 USC § 40117, a PFC is a charge imposed by a public agency on passengers enplaned at a commercial service airport it controls."

10-35 **Pavement**. The combined surface course, base course, and subbase course, if any, considered as a single unit.

10-36 **Payment Bond**. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will pay in full all bills and accounts for materials and labor used in the construction of the work.

10-37 **Performance Bond**. The approved form of security furnished by the Contractor and his or her surety as a guaranty that the Contractor will complete the work in accordance with the terms of the contract.

10-38 **Plans**. The official drawings or exact reproductions which show the location, character, dimensions and details of the airport and the work to be done and which are to be considered as a part of the contract, supplementary to the specifications.

10-39 **Project**. The agreed scope of work for accomplishing specific airport development with respect to a particular airport.

10-40 **Proposal**. The written offer of the bidder (when submitted on the approved proposal form) to perform the contemplated work and furnish the necessary materials in accordance with the provisions of the plans and specifications.

10-41 **Proposal Guaranty**. The security furnished with a proposal to guarantee that the bidder will enter into a contract if his or her proposal is accepted by the OWNER.

10-42 **Runway**. The area on the airport prepared for the landing and takeoff of aircraft.

10-43 **Specifications**. A part of the contract containing the written directions and requirements for completing the contract work. Standards for specifying materials or testing which are cited in the contract specifications by reference shall have the same force and effect as if included in the contract physically.

10-44 **Sponsor**. A Sponsor is defined in 49 USC § 47102(24) as a public agency that submits to the FAA for an AIP grant; or a private Owner of a public-use airport that submits to the FAA an application for an AIP grant for the airport.

10-45 **Structures**. Airport facilities such as bridges; culverts; catch basins, inlets, retaining walls, cribbing; storm and sanitary sewer lines; water lines; underdrains; electrical ducts, manholes, handholes, lighting fixtures and bases; transformers; flexible and rigid pavements; navigational aids; buildings; vaults; and, other manmade features of the airport that may be encountered in the work and not otherwise classified herein.

10-46 **Subgrade**. The soil that forms the pavement foundation.

10-47 **Superintendent**. The Contractor's executive representative who is present on the work during progress, authorized to receive and fulfill instructions from the ENGINEER, and who shall supervise and direct the construction.

10-48 **Supplemental Agreement**. A written agreement between the Contractor and the OWNER covering (1) work that would increase or decrease the total amount of the awarded contract, or any major contract item, by more than 25%, such increased or decreased work being within the scope of the originally awarded contract; or (2) work that is not within the scope of the originally awarded contract.

10-49 **Surety**. The corporation, partnership, or individual, other than the Contractor, executing payment or performance bonds that are furnished to the OWNER by the Contractor.

10-50 **Taxiway**. For the purpose of this document, the term taxiway means the portion of the air operations area of an airport that has been designated by competent airport authority for movement of aircraft to and from the airport's runways, aircraft parking areas, and terminal areas.

10-51 **Work**. The furnishing of all labor, materials, tools, equipment, and incidentals necessary or convenient to the Contractor's performance of all duties and obligations imposed by the contract, plans, and specifications.

10-52 **Working Day**. ***Deleted.*** ~~A working day shall be any day other than a legal holiday, Saturday, or Sunday on which the normal working forces of the Contractor may proceed with regular work for at least six (6) hours toward completion of the contract. When work is suspended for causes beyond the Contractor's control, it will not be counted as a working day. Saturdays, Sundays and holidays on which the Contractor's forces engage in regular work will be considered as working days.~~

END OF SECTION 10

SECTION 20

PROPOSAL REQUIREMENTS AND CONDITIONS

20-01 Advertisement (Notice to Bidders). See Appendix A.

20-02 Qualification of Bidders. *Each bidder shall have been prequalified by New Hanover County.* ~~Each bidder shall furnish the OWNER satisfactory evidence of his or her competency to perform the proposed work. Such evidence of competency, unless otherwise specified, shall consist of statements covering the bidder's past experience on similar work, a list of equipment that would be available for the work, and a list of key personnel that would be available. In addition, each bidder shall furnish the OWNER satisfactory evidence of his or her financial responsibility. Such evidence of financial responsibility, unless otherwise specified, shall consist of a confidential statement or report of the bidder's financial resources and liabilities as of the last calendar year or the bidder's last fiscal year. Such statements or reports shall be certified by a public accountant. At the time of submitting such financial statements or reports, the bidder shall further certify whether his or her financial responsibility is approximately the same as stated or reported by the public accountant. If the bidder's financial responsibility has changed, the bidder shall qualify the public accountant's statement or report to reflect the bidder's true financial condition at the time such qualified statement or report is submitted to the OWNER.~~

~~Unless otherwise specified, a bidder may submit evidence that he or she is prequalified with the State Highway Division and is on the current "bidder's list" of the state in which the proposed work is located. Such evidence of State Highway Division prequalification may be submitted as evidence of financial responsibility in lieu of the certified statements or reports specified above.~~

~~Each bidder shall submit "evidence of competency" and "evidence of financial responsibility" to the OWNER at the time of bid opening.~~

20-03 Contents of Proposal Forms. The OWNER shall furnish bidders with proposal forms. All papers bound with or attached to the proposal forms are necessary parts and must not be detached.

The plans, specifications, and other documents designated in the proposal form shall be considered a part of the proposal whether attached or not.

20-04 Issuance of Proposal Forms. The OWNER reserves the right to refuse to issue a proposal form to a prospective bidder should such bidder be in default for any of the following reasons:

a. Failure to comply with any prequalification regulations of the OWNER, if

such regulations are cited, or otherwise included, in the proposal as a requirement for bidding.

b. Failure to pay, or satisfactorily settle, all bills due for labor and materials on former contracts in force with the OWNER at the time the OWNER issues the proposal to a prospective bidder.

c. Documented record of Contractor default under previous contracts with the OWNER.

d. Documented record of unsatisfactory work on previous contracts with the OWNER.

20-05 Interpretation of Estimated Proposal Quantities. ***Deleted.*** *Project is bidding in lump sum format.* ~~An estimate of quantities of work to be done and materials to be furnished under these specifications is given in the proposal. It is the result of careful calculations and is believed to be correct. It is given only as a basis for comparison of proposals and the award of the contract. The OWNER does not expressly, or by implication, agree that the actual quantities involved will correspond exactly therewith; nor shall the bidder plead misunderstanding or deception because of such estimates of quantities, or of the character, location, or other conditions pertaining to the work. Payment to the Contractor will be made only for the actual quantities of work performed or materials furnished in accordance with the plans and specifications. It is understood that the quantities may be increased or decreased as hereinafter provided in the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 without in any way invalidating the unit bid prices.~~

20-06 Examination of Plans, Specifications, and Site. The bidder is expected to carefully examine the site of the proposed work, the proposal, plans, specifications, and contract forms. Bidders shall satisfy themselves as to the character, quality, and quantities of work to be performed, materials to be furnished, and as to the requirements of the proposed contract. The submission of a proposal shall be prima facie evidence that the bidder has made such examination and is satisfied as to the conditions to be encountered in performing the work and as to the requirements of the proposed contract, plans, and specifications.

Boring logs and other records of subsurface investigations and tests are available for inspection of bidders. It is understood and agreed that such subsurface information, whether included in the plans, specifications, or otherwise made available to the bidder, was obtained and is intended for the OWNER's design and estimating purposes only. Such information has been made available for the convenience of all bidders. It is further understood and agreed that each bidder is solely responsible for all assumptions, deductions,

or conclusions which the bidder may make or obtain from his or her examination of the boring logs and other records of subsurface investigations and tests that are furnished by the OWNER.

20-07 Preparation of Proposal. The bidder shall submit his or her proposal on the forms furnished by the OWNER. All blank spaces in the proposal forms must be correctly filled in where indicated for each and every item ~~for which a quantity is given~~. The bidder shall state the price (written in ink or typed) both in words and numerals for which they propose to do for each pay item furnished in the proposal. In case of conflict between words and numerals, the words, unless obviously incorrect, shall govern.

The bidder shall sign the proposal correctly and in ink. If the proposal is made by an individual, his or her name and post office address must be shown. If made by a partnership, the name and post office address of each member of the partnership must be shown. If made by a corporation, the person signing the proposal shall give the name of the state under the laws of which the corporation was chartered and the name, titles, and business address of the president, secretary, and the treasurer. Anyone signing a proposal as an agent shall file evidence of his or her authority to do so and that the signature is binding upon the firm or corporation.

20-08 Responsive and Responsible Bidder. A responsive bid conforms to all significant terms and conditions contained in the Sponsor's invitation for bid. It is the Sponsor's responsibility to decide if the exceptions taken by a bidder to the solicitation are material or not and the extent of deviation it is willing to accept.

A responsible bidder has the ability to perform successfully under the terms and conditions of a proposed procurement, as defined in 49 CFR § 18.36(b)(8). This includes such matters as Contractor integrity, compliance with public policy, record of past performance, and financial and technical resources.

20-09 Irregular Proposals. Proposals shall be considered irregular for the following reasons:

a. If the proposal is on a form other than that furnished by the OWNER, or if the OWNER's form is altered, or if any part of the proposal form is detached.

b. If there are unauthorized additions, conditional or alternate pay items, or irregularities of any kind that make the proposal incomplete, indefinite, or otherwise ambiguous.

c. If the proposal does not contain a ~~unit~~ price for each pay item listed in the proposal, ~~except in the case of authorized alternate pay items, for which the~~

~~bidder is not required to furnish a unit price~~.

d. If the proposal contains ~~unit~~ prices that are obviously unbalanced.

e. If the proposal is not accompanied by the proposal guaranty specified by the OWNER.

The OWNER reserves the right to reject any irregular proposal and the right to waive technicalities if such waiver is in the best interest of the OWNER and conforms to local laws and ordinances pertaining to the letting of construction contracts.

20-10 Bid Guarantee. Each separate proposal shall be accompanied by a certified check, or other specified acceptable collateral, in the amount specified in the proposal form. Such check, or collateral, shall be made payable to the OWNER.

20-11 Delivery of Proposal. Each proposal submitted shall be placed in a sealed envelope plainly marked with the project number, location of airport, and name and business address of the bidder on the outside. When sent by mail, preferably registered, the sealed proposal, marked as indicated above, should be enclosed in an additional envelope. No proposal will be considered unless received at the place specified in the advertisement or as modified by Addendum before the time specified for opening all bids. Proposals received after the bid opening time shall be returned to the bidder unopened.

20-12 Withdrawal or Revision of Proposals. A bidder may withdraw or revise (by withdrawal of one proposal and submission of another) a proposal provided that the bidder's request for withdrawal is received by the OWNER in writing or by fax or email before the time specified for opening bids. Revised proposals must be received at the place specified in the advertisement before the time specified for opening all bids.

20-13 Public Opening of Proposals. Proposals shall be opened, and read, publicly at the time and place specified in the advertisement. Bidders, their authorized agents, and other interested persons are invited to attend. Proposals that have been withdrawn (by written or telegraphic request) or received after the time specified for opening bids shall be returned to the bidder unopened.

20-14 Disqualification of Bidders. A bidder shall be considered disqualified for any of the following reasons:

a. Submitting more than one proposal from the same partnership, firm, or corporation under the same or different name.

b. Evidence of collusion among bidders. Bidders participating in such collusion

shall be disqualified as bidders for any future work of the OWNER until any such participating bidder has been reinstated by the OWNER as a qualified bidder.

c. If the bidder is considered to be in "default" for any reason specified in the subsection 20-04 titled ISSUANCE OF PROPOSAL FORMS of this section.

END OF SECTION 20

SECTION 30

AWARD AND EXECUTION OF CONTRACT

30-01 Consideration of Proposals. After the proposals are publicly opened and read, they will be compared on the basis of the *lump sum base bid* ~~summation of the products obtained by multiplying the estimated quantities shown in the proposal by the unit bid prices~~. If a bidder's proposal contains a discrepancy between ~~unit~~ bid prices written in words and ~~unit~~ bid prices written in numbers, the ~~unit~~ price written in words shall govern.

Until the award of a contract is made, the OWNER reserves the right to reject a bidder's proposal for any of the following reasons:

a. If the proposal is irregular as specified in the subsection 20-09 titled IRREGULAR PROPOSALS of Section 20.

b. If the bidder is disqualified for any of the reasons specified in the subsection 20-14 titled DISQUALIFICATION OF BIDDERS of Section 20.

In addition, until the award of a contract is made, the OWNER reserves the right to reject any or all proposals, waive technicalities, if such waiver is in the best interest of the OWNER and is in conformance with applicable state and local laws or regulations pertaining to the letting of construction contracts; advertise for new proposals; or proceed with the work otherwise. All such actions shall promote the OWNER's best interests.

30-02 Award of Contract. The award of a contract, if it is to be awarded, shall be made within 120 calendar days of the date specified for publicly opening proposals, unless otherwise specified herein.

Award of the contract shall be made by the OWNER to the lowest, qualified bidder whose proposal conforms to the cited requirements of the OWNER.

30-03 Cancellation of Award. The OWNER reserves the right to cancel the award without liability to the bidder, except return of proposal guaranty, at any time before a contract has been fully executed by all parties and is approved by the OWNER in accordance with the subsection 30-07 titled APPROVAL OF CONTRACT of this section.

30-04 Return of Proposal Guaranty. All proposal guaranties, except those of the two lowest bidders, will be returned immediately after the OWNER has made a comparison of bids as specified in the subsection 30-01 titled CONSIDERATION OF PROPOSALS of this section. Proposal guaranties of the two lowest bidders will be retained by the OWNER until such time as an award

is made, at which time, the unsuccessful bidder's proposal guaranty will be returned. The successful bidder's proposal guaranty will be returned as soon as the OWNER receives the contract bonds as specified in the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section.

30-05 Requirements of Contract Bonds. At the time of the execution of the contract, the successful bidder shall furnish the OWNER a surety bond or bonds that have been fully executed by the bidder and the surety guaranteeing the performance of the work and the payment of all legal debts that may be incurred by reason of the Contractor's performance of the work. The surety and the form of the bond or bonds shall be acceptable to the OWNER. Unless otherwise specified in this subsection, the surety bond or bonds shall be in a sum equal to the full amount of the contract.

30-06 Execution of Contract. The successful bidder shall sign (execute) the necessary agreements for entering into the contract and return the signed contract to the OWNER, along with the fully executed surety bond or bonds specified in the subsection 30-05 titled REQUIREMENTS OF CONTRACT BONDS of this section, within 15 calendar days from the date mailed or otherwise delivered to the successful bidder.

30-07 Approval of Contract. Upon receipt of the contract and contract bond or bonds that have been executed by the successful bidder, the OWNER shall complete the execution of the contract in accordance with local laws or ordinances, and return the fully executed contract to the Contractor. Delivery of the fully executed contract to the Contractor shall constitute the OWNER's approval to be bound by the successful bidder's proposal and the terms of the contract.

30-08 Failure to Execute Contract. Failure of the successful bidder to execute the contract and furnish an acceptable surety bond or bonds within the 15 calendar day period specified in the subsection 30-06 titled EXECUTION OF CONTRACT of this section shall be just cause for cancellation of the award and forfeiture of the proposal guaranty, not as a penalty, but as liquidation of damages to the OWNER.

END OF SECTION 30

SECTION 40

SCOPE OF WORK

40-01 **Intent of Contract**. The intent of the contract is to provide for construction and completion, in every detail, of the work described. It is further intended that the Contractor shall furnish all labor, materials, equipment, tools, transportation, and supplies required to complete the work in accordance with the plans, specifications, and terms of the contract.

40-02 **Alteration of Work and Quantities**. The OWNER reserves and shall have the right to make such alterations in the work as may be necessary or desirable to complete the work originally intended in an acceptable manner. Unless otherwise specified herein, the ENGINEER shall be and is hereby authorized to make such alterations in the work as may increase or decrease the originally awarded contract *work* ~~quantities~~, provided that the aggregate of such alterations does not change the total contract cost or the total cost of any major contract item by more than 25% ~~(total cost being based on the unit prices and estimated quantities in the awarded contract)~~. Alterations that do not exceed the 25% limitation shall not invalidate the contract nor release the surety, and the Contractor agrees to accept payment for such alterations as if the altered work had been a part of the original contract. These alterations that are for work within the general scope of the contract shall be covered by "Change Orders" issued by the ENGINEER. Change orders for altered work shall include extensions of contract time where, in the ENGINEER's opinion, such extensions are commensurate with the amount and difficulty of added work.

Should the aggregate amount of altered work exceed the 25% limitation hereinbefore specified, such excess altered work shall be covered by supplemental agreement. If the OWNER and the Contractor are unable to agree on a unit adjustment for any contract item that requires a supplemental agreement, the OWNER reserves the right to terminate the contract with respect to the item and make other arrangements for its completion.

Supplemental agreements shall be approved by the FAA and shall include all applicable Federal contract provisions for procurement and contracting required under AIP. Supplemental agreements shall also require consent of the Contractor's surety and separate performance and payment bonds.

40-03 **Omitted Items**. The ENGINEER may, in the OWNER's best interest, omit from the work any contract item, except major contract items. Major contract items may be omitted by a supplemental agreement. Such omission of contract items shall not invalidate any other contract provision or requirement.

Should a contract item be omitted or otherwise ordered to be non-performed,

the Contractor shall be paid for all work performed toward completion of such item prior to the date of the order to omit such item. Payment for work performed shall be in accordance with the subsection 90-04 titled PAYMENT FOR OMITTED ITEMS of Section 90.

40-04 **Extra Work**. Should acceptable completion of the contract require the Contractor to perform an item of work for which no basis of payment has been provided in the original contract or previously issued change orders or supplemental agreements, the same shall be called "Extra Work." Extra Work that is within the general scope of the contract shall be covered by written change order. Change orders for such Extra Work shall contain agreed unit prices for performing the change order work in accordance with the requirements specified in the order, and shall contain any adjustment to the contract time that, in the ENGINEER's opinion, is necessary for completion of such Extra Work.

When determined by the ENGINEER to be in the OWNER's best interest, the ENGINEER may order the Contractor to proceed with Extra Work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. Extra Work that is necessary for acceptable completion of the project, but is not within the general scope of the work covered by the original contract shall be covered by a Supplemental Agreement as defined in the subsection 10-48 titled SUPPLEMENTAL AGREEMENT of Section 10.

Any claim for payment of Extra Work that is not covered by written agreement (change order or supplemental agreement) shall be rejected by the OWNER.

40-05 **Maintenance of Traffic**. It is the explicit intention of the contract that the safety of aircraft, as well as the Contractor's equipment and personnel, is the most important consideration.

a. It is understood and agreed that the Contractor shall provide for the free and unobstructed movement of aircraft in the air operations areas (AOAs) of the airport with respect to his or her own operations and the operations of all subcontractors as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80. It is further understood and agreed that the Contractor shall provide for the uninterrupted operation of visual and electronic signals (including power supplies thereto) used in the guidance of aircraft while operating to, from, and upon the airport as specified in the subsection 70-15 titled CONTRACTOR'S RESPONSIBILITY FOR UTILITY SERVICE AND FACILITIES OF OTHERS in Section 70.

b. With respect to his or her own operations and the operations of all subcontractors, the Contractor shall provide marking, lighting, and other acceptable means of identifying personnel, equipment, vehicles, storage

areas, and any work area or condition that may be hazardous to the operation of aircraft, fire-rescue equipment, or maintenance vehicles at the airport.

c. When the contract requires the maintenance of vehicular traffic on an existing road, street, or highway during the Contractor's performance of work that is otherwise provided for in the contract, plans, and specifications, the Contractor shall keep such road, street, or highway open to all traffic and shall provide such maintenance as may be required to accommodate traffic. The Contractor shall be responsible for the repair of any damage caused by the Contractor's equipment and personnel. The Contractor shall furnish, erect, and maintain barricades, warning signs, flag person, and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices (MUTCD) (http://mutcd.fhwa.dot.gov/), unless otherwise specified. The Contractor shall also construct and maintain in a safe condition any temporary connections necessary for ingress to and egress from abutting property or intersecting roads, streets or highways. ~~**[Unless otherwise specified herein, the Contractor will not be required to furnish snow removal for such existing road, street, or highway.]**~~

40-06 Removal of Existing Structures. All existing structures encountered within the established lines, grades, or grading sections shall be removed by the Contractor, unless such existing structures are otherwise specified to be relocated, adjusted up or down, salvaged, abandoned in place, reused in the work or to remain in place. The cost of removing such existing structures shall not be measured or paid for directly, but shall be included in the ~~various contract items~~ *project lump sum price*.

Should the Contractor encounter an existing structure (above or below ground) in the work for which the disposition is not indicated on the plans, the ENGINEER shall be notified prior to disturbing such structure. The disposition of existing structures so encountered shall be immediately determined by the ENGINEER in accordance with the provisions of the contract.

Except as provided in the subsection 40-07 titled RIGHTS IN AND USE OF MATERIALS FOUND IN THE WORK of this section, it is intended that all existing materials or structures that may be encountered (within the lines, grades, or grading sections established for completion of the work) shall be used in the work as otherwise provided for in the contract and shall remain the property of the OWNER when so used in the work.

40-07 Rights In and Use of Materials Found in the Work. Should the Contractor encounter any material such as (but not restricted to) sand, stone, gravel, slag, or concrete slabs within the established lines, grades, or grading sections, the

use of which is intended by the terms of the contract to be either embankment or waste, the Contractor may at his or her option either:

a. Use such material in another contract item, providing such use is approved by the ENGINEER and is in conformance with the contract specifications applicable to such use; or,

b. Remove such material from the site, upon written approval of the ENGINEER; or

c. Use such material for the Contractor's own temporary construction on site; or,

d. Use such material as intended by the terms of the contract.

Should the Contractor wish to exercise option a., b., or c., the Contractor shall request the ENGINEER's approval in advance of such use.

~~Should the ENGINEER approve the Contractor's request to exercise option a., b., or c., the Contractor shall be paid for the excavation or removal of such material at the applicable contract price. The Contractor shall replace, at his or her own expense, such removed or excavated material with an agreed equal volume of material that is acceptable for use in constructing embankment, backfills, or otherwise to the extent that such replacement material is needed to complete the contract work. The Contractor shall not be charged for use of such material used in the work or removed from the site.~~

~~Should the ENGINEER approve the Contractor's exercise of option a., the Contractor shall be paid, at the applicable contract price, for furnishing and installing such material in accordance with requirements of the contract item in which the material is used.~~

It is understood and agreed that the Contractor shall make no claim for delays by reason of his or her exercise of option a., b., or c.

The Contractor shall not excavate, remove, or otherwise disturb any material, structure, or part of a structure which is located outside the lines, grades, or grading sections established for the work, except where such excavation or removal is provided for in the contract, plans, or specifications.

40-08 **Final Cleanup**. Upon completion of the work and before acceptance and final payment will be made, the Contractor shall remove from the site all machinery, equipment, surplus and discarded materials, rubbish, temporary structures, and stumps or portions of trees. The Contractor shall cut all brush and woods within the limits indicated and shall leave the site in a neat and presentable

condition. Material cleared from the site and deposited on adjacent property will not be considered as having been disposed of satisfactorily, unless the Contractor has obtained the written permission of such property OWNER.

END OF SECTION 40

SECTION 50

CONTROL OF WORK

50-01 Authority of the ENGINEER. The ENGINEER shall decide any and all questions which may arise as to the quality and acceptability of materials furnished, work performed, and as to the manner of performance and rate of progress of the work. The ENGINEER shall decide all questions that may arise as to the interpretation of the specifications or plans relating to the work. The ENGINEER shall determine the amount and quality of the several kinds of work performed and materials furnished which are to be paid for the under contract.

The ENGINEER does not have the authority to accept pavements that do not conform to FAA specification requirements. *This contract does not include pavements intended to support aircraft loads.*

50-02 Conformity with Plans and Specifications. All work and all materials furnished shall be in reasonably close conformity with the lines, grades, grading sections, cross-sections, dimensions, material requirements, and testing requirements that are specified (including specified tolerances) in the contract, plans or specifications.

If the ENGINEER finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications but that the portion of the work affected will, in his or her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the OWNER, the ENGINEER will advise the OWNER of his or her determination that the affected work be accepted and remain in place. In this event, the ENGINEER will document the determination and recommend to the OWNER a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. The ENGINEER's determination and recommended contract price adjustments will be based on sound engineering judgment and such tests or retests of the affected work as are, in the ENGINEER's opinion, needed. Changes in the contract price shall be covered by contract change order or supplemental agreement as applicable.

If the ENGINEER finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the ENGINEER's written orders.

For the purpose of this subsection, the term "reasonably close conformity" shall not be construed as waiving the Contractor's responsibility to complete the work in accordance with the contract, plans, and specifications. The term shall

not be construed as waiving the ENGINEER's responsibility to insist on strict compliance with the requirements of the contract, plans, and specifications during the Contractor's execution of the work, when, in the ENGINEER's opinion, such compliance is essential to provide an acceptable finished portion of the work.

For the purpose of this subsection, the term "reasonably close conformity" is also intended to provide the ENGINEER with the authority, after consultation with the FAA, to use sound engineering judgment in his or her determinations as to acceptance of work that is not in strict conformity, but will provide a finished product equal to or better than that intended by the requirements of the contract, plans and specifications.

The ENGINEER will not be responsible for the Contractor's means, methods, techniques, sequences, or procedures of construction or the safety precautions incident thereto.

50-03 Coordination of Contract, Plans, and Specifications. The contract, plans, specifications, and all referenced standards cited are essential parts of the contract requirements. A requirement occurring in one is as binding as though occurring in all. They are intended to be complementary and to describe and provide for a complete work. In case of discrepancy, calculated dimensions will govern over scaled dimensions; contract technical specifications shall govern over contract general provisions, plans, cited standards for materials or testing, and cited advisory circulars (ACs); contract general provisions shall govern over plans, cited standards for materials or testing, and cited ACs; plans shall govern over cited standards for materials or testing and cited ACs. If any paragraphs contained in the Special Provisions conflict with General Provisions or Technical Specifications, the Special Provisions shall govern.

From time to time, discrepancies within cited testing standards occur due to the timing of the change, edits, and/or replacement of the standards. If the Contractor discovers any apparent discrepancy within standard test methods, the Contractor shall immediately ask the ENGINEER for an interpretation and decision, and such decision shall be final.

~~**LIST OF SPECIAL PROVISIONS**~~
~~**[ ]**~~

50-04 Cooperation of Contractor. The Contractor will be supplied with five copies each of the plans and specifications. The Contractor shall have available on the work at all times one copy each of the plans and specifications. Additional copies of plans and specifications may be obtained by the Contractor for the cost of reproduction.

The Contractor shall give constant attention to the work to facilitate the progress thereof, and shall cooperate with the ENGINEER and his or her inspectors and with other contractors in every way possible. The Contractor shall have a competent superintendent on the work at all times who is fully authorized as his or her agent on the work. The superintendent shall be capable of reading and thoroughly understanding the plans and specifications and shall receive and fulfill instructions from the ENGINEER or his or her authorized representative.

50-05 Cooperation Between Contractors. The OWNER reserves the right to contract for and perform other or additional work on or near the work covered by this contract.

When separate contracts are let within the limits of any one project, each Contractor shall conduct the work so as not to interfere with or hinder the progress of completion of the work being performed by other Contractors. Contractors working on the same project shall cooperate with each other as directed.

Each Contractor involved shall assume all liability, financial or otherwise, in connection with his or her contract and shall protect and save harmless the OWNER from any and all damages or claims that may arise because of inconvenience, delays, or loss experienced because of the presence and operations of other Contractors working within the limits of the same project.

The Contractor shall arrange his or her work and shall place and dispose of the materials being used so as not to interfere with the operations of the other Contractors within the limits of the same project. The Contractor shall join his or her work with that of the others in an acceptable manner and shall perform it in proper sequence to that of the others.

50-06 Construction Layout and Stakes. The ENGINEER shall establish horizontal and vertical control only. The Contractor must establish all layout required for the construction of the work. Such stakes and markings as the ENGINEER may set for either their own or the Contractor's guidance shall be preserved by the Contractor. In case of negligence on the part of the Contractor, or their employees, resulting in the destruction of such stakes or markings, an amount equal to the cost of replacing the same may be deducted from subsequent estimates due the Contractor at the discretion of the ENGINEER.

The Contractor will be required to furnish all lines, grades and measurements from the control points necessary for the proper execution and control of the work contracted for under these specifications.

The Contractor must give copies of survey notes to the ENGINEER for each

area of construction and for each placement of material as specified to allow the ENGINEER to make periodic checks for conformance with plan grades, alignments and grade tolerances required by the applicable material specifications. All surveys must be provided to the ENGINEER prior to commencing work items that will cover or disturb the survey staking as set by the Contractor's surveyor. Survey(s) and notes shall be provided in the following format(s): PDF and/or AutoCad. In the case of error, on the part of the Contractor, their surveyor, employees or subcontractors, resulting in established grades, alignment or grade tolerances that do not concur with those specified or shown on the plans, the Contractor is solely responsible for correction, removal, replacement and all associated costs at no additional cost to the OWNER.

No direct payment will be made, unless otherwise specified in contract documents, for this labor, materials, or other expenses. The cost shall be included in the *lump sum* price of the bid ~~for the various items of the Contract~~.

Construction Staking and Layout includes but is not limited to:

a. Existing building structural elements and floor elevations.
b. Building foundation, columns, walls.
c. Storm drainage.
d. Utilities.
e. Site grading.
f. Retaining walls.
g. Pavement subgrade and base courses.
h. Concrete pavement lanes, form lines, and grades.
i. Curb and gutter, and sidewalks.
j. Asphalt pavement lines and grades.
k. Pavement markings.

~~**a.** Clearing and Grubbing perimeter staking~~
~~**b.** Rough Grade slope stakes at 100-foot stations~~
~~**c.** Drainage Swales slope stakes and flow line blue tops at 50-foot stations~~

~~Subgrade blue tops at 25-foot stations and 25-foot offset distance (maximum) for the following section locations:~~

~~**a.** Runway – minimum five (5) per station~~
~~**b.** Taxiways – minimum three (3) per station~~
~~**c.** Holding apron areas – minimum three (3) per station~~
~~**d.** Roadways – minimum three (3) per station~~

~~Base Course blue tops at 25-foot stations and 25-foot offset distance (maximum) for the following section locations:~~

~~a. Runway – minimum five (5) per station~~
~~b. Taxiways – minimum three (3) per station~~
~~c. Holding apron areas – minimum three (3) per station~~

~~Pavement areas:~~

~~**a.** Edge of Pavement hubs and tacks (for stringline by Contractor) at 100-foot stations.~~
~~**b.** Between Lifts at 25-foot stations for the following section locations:~~
~~**(1)** Runways – each paving lane width~~
~~**(2)** Taxiways – each paving lane width~~
~~**(3)** Holding areas – each paving lane width~~
~~**c.** After finish paving operations at 50-foot stations:~~
~~**(1)** All paved areas – Edge of each paving lane prior to next paving lot~~
~~**d.** Shoulder and safety area blue tops at 50-foot stations and at all break points with maximum of 50-foot offsets.~~
~~**e.** Fence lines at 100-foot stations minimum.~~
~~**f.** Electrical and Communications System locations, lines and grades including but not limited to duct runs, connections, fixtures, signs, lights, Visual Approach Slope Indicators (VASIs), Precision Approach Path Indicators (PAPIs), Runway End Identifier Lighting (REIL), Wind Cones, Distance Markers (signs), pull boxes and manholes.~~
~~**g.** Drain lines, cut stakes and alignment on 25-foot stations, inlet and manholes.~~
~~**h.** Painting and Striping layout (pinned with 1.5 inch PK nails) marked for paint Contractor. (All nails shall be removed after painting).~~
~~**i.** Laser, or other automatic control devices, shall be checked with temporary control point or grade hub at a minimum of once per 400 feet per pass (that is, paving lane).~~

The establishment of Survey Control and/or reestablishment of survey control shall be by a State Licensed Land Surveyor.

Controls and stakes disturbed or suspect of having been disturbed shall be checked and/or reset as directed by the ENGINEER without additional cost to the OWNER.

50-07 Automatically Controlled Equipment. Whenever batching or mixing plant equipment is required to be operated automatically under the contract and a breakdown or malfunction of the automatic controls occurs, the equipment may be operated manually or by other methods for a period 48 hours following the breakdown or malfunction, provided this method of operations will produce results which conform to all other requirements of the contract.

50-08 Authority and Duties of Inspectors. Inspectors shall be authorized to inspect all work done and all material furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. Inspectors are not authorized to revoke, alter, or waive any provision of the contract. Inspectors are not authorized to issue instructions contrary to the plans and specifications or to act as foreman for the Contractor.

Inspectors are authorized to notify the Contractor or his or her representatives of any failure of the work or materials to conform to the requirements of the contract, plans, or specifications and to reject such nonconforming materials in question until such issues can be referred to the ENGINEER for a decision.

50-09 Inspection of the Work. All materials and each part or detail of the work shall be subject to inspection. The ENGINEER shall be allowed access to all parts of the work and shall be furnished with such information and assistance by the Contractor as is required to make a complete and detailed inspection.

If the ENGINEER requests it, the Contractor, at any time before acceptance of the work, shall remove or uncover such portions of the finished work as may be directed. After examination, the Contractor shall restore said portions of the work to the standard required by the specifications. Should the work thus exposed or examined prove acceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be paid for as extra work; but should the work so exposed or examined prove unacceptable, the uncovering, or removing, and the replacing of the covering or making good of the parts removed will be at the Contractor's expense.

Any work done or materials used without supervision or inspection by an authorized representative of the OWNER may be ordered removed and replaced at the Contractor's expense unless the OWNER's representative failed to inspect after having been given reasonable notice in writing that the work was to be performed.

Should the contract work include relocation, adjustment, or any other modification to existing facilities, not the property of the (contract) OWNER, authorized representatives of the Owners of such facilities shall have the right to inspect such work. Such inspection shall in no sense make any facility owner a party to the contract, and shall in no way interfere with the rights of the parties to this contract.

50-10 Removal of Unacceptable and Unauthorized Work. All work that does not conform to the requirements of the contract, plans, and specifications will be considered unacceptable, unless otherwise determined acceptable by the ENGINEER as provided in the subsection 50-02 titled CONFORMITY WITH PLANS AND SPECIFICATIONS of this section.

Unacceptable work, whether the result of poor workmanship, use of defective materials, damage through carelessness, or any other cause found to exist prior to the final acceptance of the work, shall be removed immediately and replaced in an acceptable manner in accordance with the provisions of the subsection 70-14 titled CONTRACTOR'S RESPONSIBILITY FOR WORK of Section 70.

No removal work made under provision of this subsection shall be done without lines and grades having been established by the ENGINEER. Work done contrary to the instructions of the ENGINEER, work done beyond the lines shown on the plans or as established by the ENGINEER, except as herein specified, or any extra work done without authority, will be considered as unauthorized and will not be paid for under the provisions of the contract. Work so done may be ordered removed or replaced at the Contractor's expense.

Upon failure on the part of the Contractor to comply with any order of the ENGINEER made under the provisions of this subsection, the ENGINEER will have authority to cause unacceptable work to be remedied or removed and replaced and unauthorized work to be removed and to deduct the costs incurred by the OWNER from any monies due or to become due the Contractor.

50-11 Load Restrictions. The Contractor shall comply with all legal load restrictions in the hauling of materials on public roads beyond the limits of the work. A special permit will not relieve the Contractor of liability for damage that may result from the moving of material or equipment.

The operation of equipment of such weight or so loaded as to cause damage to structures or to any other type of construction will not be permitted. Hauling of materials over the base course or surface course under construction shall be limited as directed. No loads will be permitted on a concrete pavement, base, or structure before the expiration of the curing period. The Contractor shall be responsible for all damage done by his or her hauling equipment and shall correct such damage at his or her own expense.

50-12 Maintenance During Construction. The Contractor shall maintain the work during construction and until the work is accepted. Maintenance shall constitute continuous and effective work prosecuted day by day, with adequate equipment and forces so that the work is maintained in satisfactory condition at all times.

In the case of a contract for the placing of a course upon a course or subgrade previously constructed, the Contractor shall maintain the previous course or subgrade during all construction operations.

All costs of maintenance work during construction and before the project is accepted shall be included in the ~~unit prices bid on the various contract items~~ *project lump sum price*, and the Contractor will not be paid an additional amount for such work.

50-13 Failure to Maintain the Work. Should the Contractor at any time fail to maintain the work as provided in the subsection 50-12 titled MAINTENANCE DURING CONSTRUCTION of this section, the ENGINEER shall immediately notify the Contractor of such noncompliance. Such notification shall specify a reasonable time within which the Contractor shall be required to remedy such unsatisfactory maintenance condition. The time specified will give due consideration to the exigency that exists.

Should the Contractor fail to respond to the ENGINEER's notification, the OWNER may suspend any work necessary for the OWNER to correct such unsatisfactory maintenance condition, depending on the exigency that exists. Any maintenance cost incurred by the OWNER, shall be deducted from monies due or to become due the Contractor.

50-14 Partial Acceptance. If at any time during the execution of the project the Contractor substantially completes a usable unit or portion of the work, the occupancy of which will benefit the OWNER, the Contractor may request the ENGINEER to make final inspection of that unit. If the ENGINEER finds upon inspection that the unit has been satisfactorily completed in compliance with the contract, the ENGINEER may accept it as being complete, and the Contractor may be relieved of further responsibility for that unit. Such partial acceptance and beneficial occupancy by the OWNER shall not void or alter any provision of the contract.

50-15 Final Acceptance. Upon due notice from the Contractor of presumptive completion of the entire project, the ENGINEER and OWNER will make an inspection. If all construction provided for and contemplated by the contract is found to be complete in accordance with the contract, plans, and specifications, such inspection shall constitute the final inspection. The ENGINEER shall notify the Contractor in writing of final acceptance as of the date of the final inspection.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory, the ENGINEER will give the Contractor the necessary instructions for correction of same and the Contractor shall immediately comply with and execute such instructions. Upon correction of the work, another inspection will be made which shall constitute the final inspection, provided the work has been satisfactorily completed. In such event, the ENGINEER will make the final acceptance and notify the Contractor in writing of this acceptance as of the date of final inspection.

50-16 Claims for Adjustment and Disputes. If for any reason the Contractor deems that additional compensation is due for work or materials not clearly provided for in the contract, plans, or specifications or previously authorized as extra work, the Contractor shall notify the ENGINEER in writing of his or her intention to claim such additional compensation before the Contractor begins the work on which the Contractor bases the claim. If such notification is not given or the ENGINEER is not afforded proper opportunity by the Contractor for keeping strict account of actual cost as required, then the Contractor hereby agrees to waive any claim for such additional compensation. Such notice by the Contractor and the fact that the ENGINEER has kept account of the cost of the work shall not in any way be construed as proving or substantiating the validity of the claim. When the work on which the claim for additional compensation is based has been completed, the Contractor shall, within 10 calendar days, submit a written claim to the ENGINEER who will present it to the OWNER for consideration in accordance with local laws or ordinances.

Nothing in this subsection shall be construed as a waiver of the Contractor's right to dispute final payment based on differences in measurements or computations.

END OF SECTION 50

SECTION 60

CONTROL OF MATERIALS

60-01 Source of Supply and Quality Requirements. The materials used in the work shall conform to the requirements of the contract, plans, and specifications. Unless otherwise specified, such materials that are manufactured or processed shall be new (as compared to used or reprocessed).

In order to expedite the inspection and testing of materials, the Contractor shall furnish complete statements to the ENGINEER as to the origin, composition, and manufacture of all materials to be used in the work. Such statements shall be furnished promptly after execution of the contract but, in all cases, prior to delivery of such materials.

At the ENGINEER's option, materials may be approved at the source of supply before delivery is stated. If it is found after trial that sources of supply for previously approved materials do not produce specified products, the Contractor shall furnish materials from other sources.

~~The Contractor shall furnish airport lighting equipment that conforms to the requirements of cited materials specifications. In addition, where an FAA specification for airport lighting equipment is cited in the plans or specifications, the Contractor shall furnish such equipment that is:~~

~~**a.** Listed in advisory circular (AC) 150/5345-53, Airport Lighting Equipment Certification Program, and Addendum that is in effect on the date of advertisement; and,~~

~~**b.** Produced by the manufacturer as listed in the Addendum cited above for the certified equipment part number.~~

~~The following airport lighting equipment is required for this contract and is to be furnished by the Contractor in accordance with the requirements of this subsection: **[ ]**.~~

60-02 Samples, Tests, and Cited Specifications. Unless otherwise designated, all materials used in the work shall be inspected, tested, and approved by the ENGINEER before incorporation in the work. Any work in which untested materials are used without approval or written permission of the ENGINEER shall be performed at the Contractor's risk. Materials found to be unacceptable and unauthorized will not be paid for and, if directed by the ENGINEER, shall be removed at the Contractor's expense.

Unless otherwise designated, quality assurance tests in accordance with the

cited standard methods of ASTM, American Association of State Highway and Transportation Officials (AASHTO), Federal Specifications, Commercial Item Descriptions, and all other cited methods, which are current on the date of advertisement for bids, will be made by and at the expense of the ENGINEER.

The testing organizations performing on-site quality assurance field tests shall have copies of all referenced standards on the construction site for use by all technicians and other personnel, including the Contractor's representative at his or her request. Unless otherwise designated, samples for quality assurance will be taken by a qualified representative of the ENGINEER. All materials being used are subject to inspection, test, or rejection at any time prior to or during incorporation into the work. Copies of all tests will be furnished to the Contractor's representative at their request after review and approval of the ENGINEER.

The Contractor shall employ a testing organization to perform all Contractor required Quality Control tests. The Contractor shall submit to the ENGINEER resumes on all testing organizations and individual persons who will be performing the tests. The ENGINEER will determine if such persons are qualified. All the test data shall be reported to the ENGINEER after the results are known. A legible, handwritten copy of all test data shall be given to the ENGINEER daily, along with printed reports, in an approved format, on a weekly basis. After completion of the project, and prior to final payment, the Contractor shall submit a final report to the ENGINEER showing all test data reports, plus an analysis of all results showing ranges, averages, and corrective action taken on all failing tests.

60-03 Certification of Compliance. The ENGINEER may permit the use, prior to sampling and testing, of certain materials or assemblies when accompanied by manufacturer's certificates of compliance stating that such materials or assemblies fully comply with the requirements of the contract. The certificate shall be signed by the manufacturer. Each lot of such materials or assemblies delivered to the work must be accompanied by a certificate of compliance in which the lot is clearly identified.

Materials or assemblies used on the basis of certificates of compliance may be sampled and tested at any time and if found not to be in conformity with contract requirements will be subject to rejection whether in place or not.

The form and distribution of certificates of compliance shall be as approved by the ENGINEER.

When a material or assembly is specified by "brand name or equal" and the Contractor elects to furnish the specified "brand name," the Contractor shall be required to furnish the manufacturer's certificate of compliance for each lot of

such material or assembly delivered to the work. Such certificate of compliance shall clearly identify each lot delivered and shall certify as to:

a. Conformance to the specified performance, testing, quality or dimensional requirements; and,

b. Suitability of the material or assembly for the use intended in the contract work.

Should the Contractor propose to furnish an "or equal" material or assembly, the Contractor shall furnish the manufacturer's certificates of compliance as hereinbefore described for the specified brand name material or assembly. However, the ENGINEER shall be the sole judge as to whether the proposed "or equal" is suitable for use in the work.

The ENGINEER reserves the right to refuse permission for use of materials or assemblies on the basis of certificates of compliance.

60-04 Plant Inspection. The ENGINEER or his or her authorized representative may inspect, at its source, any specified material or assembly to be used in the work. Manufacturing plants may be inspected from time to time for the purpose of determining compliance with specified manufacturing methods or materials to be used in the work and to obtain samples required for acceptance of the material or assembly.

Should the ENGINEER conduct plant inspections, the following conditions shall exist:

a. The ENGINEER shall have the cooperation and assistance of the Contractor and the producer with whom the ENGINEER has contracted for materials.

b. The ENGINEER shall have full entry at all reasonable times to such parts of the plant that concern the manufacture or production of the materials being furnished.

c. If required by the ENGINEER, the Contractor shall arrange for adequate office or working space that may be reasonably needed for conducting plant inspections. Office or working space should be conveniently located with respect to the plant.

It is understood and agreed that the OWNER shall have the right to retest any material that has been tested and approved at the source of supply after it has been delivered to the site. The ENGINEER shall have the right to reject only material which, when retested, does not meet the requirements of the contract,

plans, or specifications.

60-05 Engineer's Field Office. An ENGINEER's field office is not required.

60-06 Storage of Materials. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, may again be inspected prior to their use in the work. Stored materials shall be located to facilitate their prompt inspection. The Contractor shall coordinate the storage of all materials with the ENGINEER. Materials to be stored on airport property shall not create an obstruction to air navigation nor shall they interfere with the free and unobstructed movement of aircraft. Unless otherwise shown on the plans, the storage of materials and the location of the Contractor's plant and parked equipment or vehicles shall be as directed by the ENGINEER. Private property shall not be used for storage purposes without written permission of the owner or lessee of such property. The Contractor shall make all arrangements and bear all expenses for the storage of materials on private property. Upon request, the Contractor shall furnish the ENGINEER a copy of the property owner's permission.

All storage sites on private or airport property shall be restored to their original condition by the Contractor at his or her entire expense, except as otherwise agreed to (in writing) by the owner or lessee of the property.

60-07 Unacceptable Materials. Any material or assembly that does not conform to the requirements of the contract, plans, or specifications shall be considered unacceptable and shall be rejected. The Contractor shall remove any rejected material or assembly from the site of the work, unless otherwise instructed by the ENGINEER.

Rejected material or assembly, the defects of which have been corrected by the Contractor, shall not be returned to the site of the work until such time as the ENGINEER has approved its use in the work.

60-08 Owner Furnished Materials. The Contractor shall furnish all materials required to complete the work, except those specified, if any, to be furnished by the OWNER. OWNER-furnished materials shall be made available to the Contractor at the location specified.

All costs of handling, transportation from the specified location to the site of work, storage, and installing OWNER-furnished materials shall be included in the ~~unit price bid for the contract item in which such OWNER-furnished material is used~~ *project lump sum price*.

After any OWNER-furnished material has been delivered to the location

specified, the Contractor shall be responsible for any demurrage, damage, loss, or other deficiencies that may occur during the Contractor's handling, storage, or use of such OWNER-furnished material. The OWNER will deduct from any monies due or to become due the Contractor any cost incurred by the OWNER in making good such loss due to the Contractor's handling, storage, or use of OWNER-furnished materials.

END OF SECTION 60

SECTION 70

LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

70-01 **Laws to be Observed**. The Contractor shall keep fully informed of all Federal and state laws, all local laws, ordinances, and regulations and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. The Contractor shall at all times observe and comply with all such laws, ordinances, regulations, orders, and decrees; and shall protect and indemnify the OWNER and all his or her officers, agents, or servants against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order, or decree, whether by the Contractor or the Contractor's employees.

70-02 **Permits, Licenses, and Taxes**. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful execution of the work.

70-03 **Patented Devices, Materials, and Processes**. If the Contractor is required or desires to use any design, device, material, or process covered by letters of patent or copyright, the Contractor shall provide for such use by suitable legal agreement with the Patentee or owner. The Contractor and the surety shall indemnify and hold harmless the OWNER, any third party, or political subdivision from any and all claims for infringement by reason of the use of any such patented design, device, material or process, or any trademark or copyright, and shall indemnify the OWNER for any costs, expenses, and damages which it may be obliged to pay by reason of an infringement, at any time during the execution or after the completion of the work.

70-04 **Restoration of Surfaces Disturbed by Others**. The OWNER reserves the right to authorize the construction, reconstruction, or maintenance of any public or private utility service, FAA or National Oceanic and Atmospheric Administration (NOAA) facility, or a utility service of another government agency at any time during the progress of the work. To the extent that such construction, reconstruction, or maintenance has been coordinated with the OWNER, such authorized work (by others) is indicated as follows:

Duke Energy:	Electrical
Time Warner Cable:	Service Lines
CenturyLink:	Copper and Fiber Optic Service Lines
Airport:	Fiber Optic and Copper Cables
Cape Fear Public Utilities Athority (CFPUA):	Water and Sewer

Except as listed above, the Contractor shall not permit any individual, firm, or corporation to excavate or otherwise disturb such utility services or facilities located within the limits of the work without the written permission of the ENGINEER.

Should the owner of public or private utility service, FAA, or NOAA facility, or a utility service of another government agency be authorized to construct, reconstruct, or maintain such utility service or facility during the progress of the work, the Contractor shall cooperate with such owners by arranging and performing the work in this contract to facilitate such construction, reconstruction or maintenance by others whether or not such work by others is listed above. When ordered as extra work by the ENGINEER, the Contractor shall make all necessary repairs to the work which are due to such authorized work by others, unless otherwise provided for in the contract, plans, or specifications. It is understood and agreed that the Contractor shall not be entitled to make any claim for damages due to such authorized work by others or for any delay to the work resulting from such authorized work.

70-05 Federal Aid Participation. For Airport Improvement Program (AIP) contracts, the United States Government has agreed to reimburse the OWNER for some portion of the contract costs. Such reimbursement is made from time to time upon the OWNER's request to the FAA. In consideration of the United States Government's (FAA's) agreement with the OWNER, the OWNER has included provisions in this contract pursuant to the requirements of Title 49 of the USC and the Rules and Regulations of the FAA that pertain to the work.

As required by the USC, the contract work is subject to the inspection and approval of duly authorized representatives of the FAA Administrator, and is further subject to those provisions of the rules and regulations that are cited in the contract, plans, or specifications.

No requirement of the USC, the rules and regulations implementing the USC, or this contract shall be construed as making the Federal Government a party to the contract nor will any such requirement interfere, in any way, with the rights of either party to the contract.

70-06 Sanitary, Health, and Safety Provisions. The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of his or her employees as may be necessary to comply with the requirements of the state and local Board of Health, or of other bodies or tribunals having jurisdiction.

Attention is directed to Federal, state, and local laws, rules and regulations concerning construction safety and health standards. The Contractor shall not

require any worker to work in surroundings or under conditions that are unsanitary, hazardous, or dangerous to his or her health or safety.

70-07 Public Convenience and Safety. The Contractor shall control his or her operations and those of his or her subcontractors and all suppliers, to assure the least inconvenience to the traveling public. Under all circumstances, safety shall be the most important consideration.

The Contractor shall maintain the free and unobstructed movement of aircraft and vehicular traffic with respect to his or her own operations and those of his or her subcontractors and all suppliers in accordance with the subsection 40-05 titled MAINTENANCE OF TRAFFIC of Section 40 hereinbefore specified and shall limit such operations for the convenience and safety of the traveling public as specified in the subsection 80-04 titled LIMITATION OF OPERATIONS of Section 80 hereinafter.

70-08 Barricades, Warning Signs, and Hazard Markings. The Contractor shall furnish, erect, and maintain all barricades, warning signs, and markings for hazards necessary to protect the public and the work. When used during periods of darkness, such barricades, warning signs, and hazard markings shall be suitably illuminated. Unless otherwise specified, barricades, warning signs, and markings for hazards that are in the air operations area (AOAs) shall be a maximum of 18 inches high. Unless otherwise specified, barricades shall be spaced not more than 4 feet apart. Barricades, warning signs, and markings shall be paid for under subsection 40-05.

For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual on Uniform Traffic Control Devices.

When the work requires closing an air operations area of the airport or portion of such area, the Contractor shall furnish, erect, and maintain temporary markings and associated lighting conforming to the requirements of advisory circular (AC) 150/5340-1L, Standards for Airport Markings.

The Contractor shall furnish, erect, and maintain markings and associated lighting of open trenches, excavations, temporary stock piles, and the Contractor’s parked construction equipment that may be hazardous to the operation of emergency fire-rescue or maintenance vehicles on the airport in reasonable conformance to AC 150/5370-2F, Operational Safety on Airports During Construction.

The Contractor shall identify each motorized vehicle or piece of construction equipment in reasonable conformance to AC 150/5370-2F.

The Contractor shall furnish and erect all barricades, warning signs, and markings for hazards prior to commencing work that requires such erection and shall maintain the barricades, warning signs, and markings for hazards until their removal is directed by the ENGINEER.

Open-flame type lights shall not be permitted.

70-09 Use of Explosives. *Use of explosives is not authorized.* ~~When the use of explosives is necessary for the execution of the work, the Contractor shall exercise the utmost care not to endanger life or property, including new work. The Contractor shall be responsible for all damage resulting from the use of explosives.~~

~~All explosives shall be stored in a secure manner in compliance with all laws and ordinances, and all such storage places shall be clearly marked. Where no local laws or ordinances apply, storage shall be provided satisfactory to the ENGINEER and, in general, not closer than 1,000 feet from the work or from any building, road, or other place of human occupancy.~~

~~The Contractor shall notify each property owner and public utility company having structures or facilities in proximity to the site of the work of his or her intention to use explosives. Such notice shall be given sufficiently in advance to enable them to take such steps as they may deem necessary to protect their property from injury.~~

~~The use of electrical blasting caps shall not be permitted on or within 1,000 feet of the airport property.~~

70-10 Protection and Restoration of Property and Landscape. The Contractor shall be responsible for the preservation of all public and private property, and shall protect carefully from disturbance or damage all land monuments and property markers until the ENGINEER has witnessed or otherwise referenced their location and shall not move them until directed.

The Contractor shall be responsible for all damage or injury to property of any character, during the execution of the work, resulting from any act, omission, neglect, or misconduct in manner or method of executing the work, or at any time due to defective work or materials, and said responsibility shall not be released until the project has been completed and accepted.

When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work, or in consequence of the non-execution thereof by the Contractor, the Contractor shall restore, at his or her own expense, such property to a condition similar or equal to that existing before such damage or

injury was done, by repairing, or otherwise restoring as may be directed, or the Contractor shall make good such damage or injury in an acceptable manner.

70-11 Responsibility for Damage Claims. The Contractor shall indemnify and save harmless the ENGINEER and the OWNER and their officers, and employees from all suits, actions, or claims, of any character, brought because of any injuries or damage received or sustained by any person, persons, or property on account of the operations of the Contractor; or on account of or in consequence of any neglect in safeguarding the work; or through use of unacceptable materials in constructing the work; or because of any act or omission, neglect, or misconduct of said Contractor; or because of any claims or amounts recovered from any infringements of patent, trademark, or copyright; or from any claims or amounts arising or recovered under the "Workmen's Compensation Act," or any other law, ordinance, order, or decree. Money due the Contractor under and by virtue of his or her contract considered necessary by the OWNER for such purpose may be retained for the use of the OWNER or, in case no money is due, his or her surety may be held until such suits, actions, or claims for injuries or damages shall have been settled and suitable evidence to that effect furnished to the OWNER, except that money due the Contractor will not be withheld when the Contractor produces satisfactory evidence that he or she is adequately protected by public liability and property damage insurance.

70-12 Third Party Beneficiary Clause. It is specifically agreed between the parties executing the contract that it is not intended by any of the provisions of any part of the contract to create for the public or any member thereof, a third party beneficiary or to authorize anyone not a party to the contract to maintain a suit for personal injuries or property damage pursuant to the terms or provisions of the contract.

70-13 Opening Sections of the Work to Traffic. Should it be necessary for the Contractor to complete portions of the contract work for the beneficial occupancy of the OWNER prior to completion of the entire contract, such "phasing" of the work shall be specified herein and indicated on the plans. When so specified, the Contractor shall complete such portions of the work on or before the date specified or as otherwise specified. The Contractor shall make his or her own estimate of the difficulties involved in arranging the work to permit such beneficial occupancy by the OWNER as described below:

Refer to Phasing Plans and Diagrams

Upon completion of any portion of the work listed above, such portion shall be accepted by the OWNER in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50.

No portion of the work may be opened by the Contractor for public use until ordered by the ENGINEER in writing. Should it become necessary to open a portion of the work to public traffic on a temporary or intermittent basis, such openings shall be made when, in the opinion of the ENGINEER, such portion of the work is in an acceptable condition to support the intended traffic. Temporary or intermittent openings are considered to be inherent in the work and shall not constitute either acceptance of the portion of the work so opened or a waiver of any provision of the contract. Any damage to the portion of the work so opened that is not attributable to traffic which is permitted by the OWNER shall be repaired by the Contractor at his or her expense.

The Contractor shall make his or her own estimate of the inherent difficulties involved in completing the work under the conditions herein described and shall not claim any added compensation by reason of delay or increased cost due to opening a portion of the contract work.

Contractor shall be required to conform to safety standards contained AC 150/5370-2F (see Special Provisions).

Contractor shall refer to the approved Construction Safety Phasing Plan (CSPP) to identify barricade requirements and other safety requirements prior to opening up sections of work to traffic.

70-14 Contractor's Responsibility for Work. Until the ENGINEER's final written acceptance of the entire completed work, excepting only those portions of the work accepted in accordance with the subsection 50-14 titled PARTIAL ACCEPTANCE of Section 50, the Contractor shall have the charge and care thereof and shall take every precaution against injury or damage to any part due to the action of the elements or from any other cause, whether arising from the execution or from the non-execution of the work. The Contractor shall rebuild, repair, restore, and make good all injuries or damages to any portion of the work occasioned by any of the above causes before final acceptance and shall bear the expense thereof except damage to the work due to unforeseeable causes beyond the control of and without the fault or negligence of the Contractor, including but not restricted to acts of God such as earthquake, tidal wave, tornado, hurricane or other cataclysmic phenomenon of nature, or acts of the public enemy or of government authorities.

If the work is suspended for any cause whatever, the Contractor shall be responsible for the work and shall take such precautions necessary to prevent damage to the work. The Contractor shall provide for normal drainage and shall erect necessary temporary structures, signs, or other facilities at his or her expense. During such period of suspension of work, the Contractor shall properly and continuously maintain in an acceptable growing condition all living material in newly established planting, seeding, and sodding furnished under

the contract, and shall take adequate precautions to protect new tree growth and other important vegetative growth against injury.

70-15 Contractor's Responsibility for Utility Service and Facilities of Others. As provided in the subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section, the Contractor shall cooperate with the owner of any public or private utility service, FAA or NOAA, or a utility service of another government agency that may be authorized by the owner to construct, reconstruct or maintain such utility services or facilities during the progress of the work. In addition, the Contractor shall control their operations to prevent the unscheduled interruption of such utility services and facilities.

To the extent that such public or private utility services, FAA, or NOAA facilities, or utility services of another governmental agency are known to exist within the limits of the contract work, the approximate locations have been indicated on the plans and the owners are indicated as follows:

Duke Energy:	Electrical
Spectrum:	Service Lines
CenturyLink:	Copper and Fiber Optic Service Lines
Airport:	Fiber Optic and Copper Cables
CFPUA:	Water and Sewer
Piedmont Natural Gas:	Natural Gas Lines

It is understood and agreed that the OWNER does not guarantee the accuracy or the completeness of the location information relating to existing utility services, facilities, or structures that may be shown on the plans or encountered in the work. Any inaccuracy or omission in such information shall not relieve the Contractor of the responsibility to protect such existing features from damage or unscheduled interruption of service.

It is further understood and agreed that the Contractor shall, upon execution of the contract, notify the owners of all utility services or other facilities of his or her plan of operations. Such notification shall be in writing ~~addressed to THE PERSON TO CONTACT~~ as provided in this subsection and subsection 70-04 titled RESTORATION OF SURFACES DISTURBED BY OTHERS of this section. A copy of each notification shall be given to the ENGINEER.

In addition to the general written notification provided, it shall be the responsibility of the Contractor to keep such individual owners advised of

changes in their plan of operations that would affect such owners.

Prior to beginning the work in the general vicinity of an existing utility service or facility, the Contractor shall again notify each such owner of their plan of operation. If, in the Contractor's opinion, the owner's assistance is needed to locate the utility service or facility or the presence of a representative of the owner is desirable to observe the work, such advice should be included in the notification. Such notification shall be given by the most expeditious means to reach the utility owner's PERSON TO CONTACT no later than two normal business days prior to the Contractor's commencement of operations in such general vicinity. The Contractor shall furnish a written summary of the notification to the ENGINEER.

The Contractor's failure to give the two days' notice shall be cause for the OWNER to suspend the Contractor's operations in the general vicinity of a utility service or facility.

Where the outside limits of an underground utility service have been located and staked on the ground, the Contractor shall be required to use hand excavation methods within 3 feet of such outside limits at such points as may be required to ensure protection from damage due to the Contractor's operations.

Should the Contractor damage or interrupt the operation of a utility service or facility by accident or otherwise, the Contractor shall immediately notify the proper authority and the ENGINEER and shall take all reasonable measures to prevent further damage or interruption of service. The Contractor, in such events, shall cooperate with the utility service or facility owner and the ENGINEER continuously until such damage has been repaired and service restored to the satisfaction of the utility or facility owner.

The Contractor shall bear all costs of damage and restoration of service to any utility service or facility due to their operations whether due to negligence or accident. The OWNER reserves the right to deduct such costs from any monies due or which may become due the Contractor, or his or her surety.

70-15.1 **FAA Facilities and Cable Runs.** The Contractor is hereby advised that the construction limits of the project include existing facilities and buried cable runs that are owned, operated and maintained by the FAA. The Contractor, during the execution of the project work, shall comply with the following:

a. The Contractor shall permit FAA maintenance personnel the right of access to the project work site for purposes of inspecting and maintaining all existing FAA owned facilities.

b. The Contractor shall provide notice to the FAA Air Traffic Organization (ATO)/Technical Operations/System Support Center (SSC) Point-of-Contact through the airport manager a minimum of seven (7) calendar days prior to commencement of construction activities in order to permit sufficient time to locate and mark existing buried cables and to schedule any required facility outages.

c. If execution of the project work requires a facility outage, the Contractor shall contact the FAA Point-of-Contact a minimum of 72 hours prior to the time of the required outage.

d. Any damage to FAA cables, access roads, or FAA facilities during construction caused by the Contractor's equipment or personnel whether by negligence or accident will require the Contractor to repair or replace the damaged cables, access road, or FAA facilities to FAA requirements. The Contractor shall not bear the cost to repair damage to underground facilities or utilities improperly located by the FAA.

e. If the project work requires the cutting or splicing of FAA owned cables, the FAA Point-of-Contact shall be contacted a minimum of 72 hours prior to the time the cable work commences. The FAA reserves the right to have a FAA representative on site to observe the splicing of the cables as a condition of acceptance. All cable splices are to be accomplished in accordance with FAA specifications and require approval by the FAA Point-of-Contact as a condition of acceptance by the OWNER. The Contractor is hereby advised that FAA restricts the location of where splices may be installed. If a cable splice is required in a location that is not permitted by FAA, the Contractor shall furnish and install a sufficient length of new cable that eliminates the need for any splice.

70-16 Furnishing Rights-of-Way. The OWNER will be responsible for furnishing all rights-of-way upon which the work is to be constructed in advance of the Contractor's operations.

70-17 Personal Liability of Public Officials. In carrying out any of the contract provisions or in exercising any power or authority granted by this contract, there shall be no liability upon the ENGINEER, his or her authorized representatives, or any officials of the OWNER either personally or as an official of the OWNER. It is understood that in such matters they act solely as agents and representatives of the OWNER.

70-18 No Waiver of Legal Rights. Upon completion of the work, the OWNER will expeditiously make final inspection and notify the Contractor of final acceptance. Such final acceptance, however, shall not preclude or stop the OWNER from correcting any measurement, estimate, or certificate made

before or after completion of the work, nor shall the OWNER be precluded or stopped from recovering from the Contractor or his or her surety, or both, such overpayment as may be sustained, or by failure on the part of the Contractor to fulfill his or her obligations under the contract. A waiver on the part of the OWNER of any breach of any part of the contract shall not be held to be a waiver of any other or subsequent breach.

The Contractor, without prejudice to the terms of the contract, shall be liable to the OWNER for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards the OWNER's rights under any warranty or guaranty.

70-19 Environmental Protection. The Contractor shall comply with all Federal, state, and local laws and regulations controlling pollution of the environment. The Contractor shall take necessary precautions to prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and to prevent pollution of the atmosphere from particulate and gaseous matter.

70-20 Archaeological and Historical Findings. Unless otherwise specified in this subsection, the Contractor is advised that the site of the work is not within any property, district, or site, and does not contain any building, structure, or object listed in the current National Register of Historic Places published by the United States Department of Interior.

Should the Contractor encounter, during his or her operations, any building, part of a building, structure, or object that is incongruous with its surroundings, the Contractor shall immediately cease operations in that location and notify the ENGINEER. The ENGINEER will immediately investigate the Contractor's finding and the OWNER will direct the Contractor to either resume operations or to suspend operations as directed.

Should the OWNER order suspension of the Contractor's operations in order to protect an archaeological or historical finding, or order the Contractor to perform extra work, such shall be covered by an appropriate contract change order or supplemental agreement as provided in the subsection 40-04 titled EXTRA WORK of Section 40 and the subsection 90-05 titled PAYMENT FOR EXTRA WORK of Section 90. If appropriate, the contract change order or supplemental agreement shall include an extension of contract time in accordance with the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of Section 80.

END OF SECTION 70

SECTION 80

EXECUTION AND PROGRESS

80-01 Subletting of Contract. The OWNER will not recognize any subcontractor on the work. The Contractor shall at all times when work is in progress be represented either in person, by a qualified superintendent, or by other designated, qualified representative who is duly authorized to receive and execute orders of the ENGINEER.

The Contractor shall provide copies of all subcontracts to the ENGINEER. The Contractor shall perform, with his organization, an amount of work equal to at least 25 percent of the total contract cost.

Should the Contractor elect to assign his or her contract, said assignment shall be concurred in by the surety, shall be presented for the consideration and approval of the OWNER, and shall be consummated only on the written approval of the OWNER.

80-02 Notice to Proceed. The notice to proceed shall state the date on which it is expected the Contractor will begin the construction and from which date contract time will be charged. The Contractor shall begin the work to be performed under the contract within 10 days of the date set by the ENGINEER in the written notice to proceed, but in any event, the Contractor shall notify the ENGINEER at least 24 hours in advance of the time actual construction operations will begin. The Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the OWNER.

80-03 Execution and Progress. Unless otherwise specified, the Contractor shall submit their progress schedule for the ENGINEER's approval within 10 days after the effective date of the notice to proceed. The Contractor's progress schedule, when approved by the ENGINEER, may be used to establish major construction operations and to check on the progress of the work. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the completion of the project in accordance with the plans and specifications within the time set forth in the proposal.

If the Contractor falls significantly behind the submitted schedule, the Contractor shall, upon the ENGINEER's request, submit a revised schedule for completion of the work within the contract time and modify their operations to provide such additional materials, equipment, and labor necessary to meet the revised schedule. Should the execution of the work be discontinued for any reason, the Contractor shall notify the ENGINEER at least 24 hours in advance of resuming operations.

The Contractor shall not commence any actual construction prior to the date on which the notice to proceed is issued by the OWNER.

80-04 Limitation of Operations. The Contractor shall control his or her operations and the operations of his or her subcontractors and all suppliers to provide for the free and unobstructed movement of aircraft in the air operations areas (AOA) of the airport.

When the work requires the Contractor to conduct his or her operations within an AOA of the airport, the work shall be coordinated with airport operations (through the ENGINEER) at least 48 hours prior to commencement of such work. The Contractor shall not close an AOA until so authorized by the ENGINEER and until the necessary temporary marking and associated lighting is in place as provided in the subsection 70-08 titled BARRICADES, WARNING SIGNS, AND HAZARD MARKINGS of Section 70.

When the contract work requires the Contractor to work within an AOA of the airport on an intermittent basis (intermittent opening and closing of the AOA), the Contractor shall maintain constant communications as specified; immediately obey all instructions to vacate the AOA; immediately obey all instructions to resume work in such AOA. Failure to maintain the specified communications or to obey instructions shall be cause for suspension of the Contractor's operations in the AOA until the satisfactory conditions are provided. The following AOA cannot be closed to operating aircraft to permit the Contractor's operations on a continuous basis and will therefore be closed to aircraft operations intermittently as follows:

Refer to Project Plans for Partial Closure of the Air Carrier Apron

Contractor shall be required to conform to safety standards contained in AC 150/5370-2F, Operational Safety on Airports During Construction (see Special Provisions).

80-04.1 Operational Safety on Airport During Construction. All Contractors' operations shall be conducted in accordance with the project Construction Safety and Phasing Plan (CSPP) and the provisions set forth within the current version of AC 150/5370-2F. The CSPP included within the contract documents conveys minimum requirements for operational safety on the airport during construction activities. The Contractor shall prepare and submit a Safety Plan Compliance Document that details how it proposes to comply with the requirements presented within the CSPP.

The Contractor shall implement all necessary safety plan measures prior to commencement of any work activity. The Contractor shall conduct routine

checks to assure compliance with the safety plan measures.

The Contractor is responsible to the OWNER for the conduct of all subcontractors it employs on the project. The Contractor shall assure that all subcontractors are made aware of the requirements of the CSPP and that they implement and maintain all necessary measures.

No deviation or modifications may be made to the approved CSPP unless approved in writing by the OWNER or ENGINEER.

80-05 Character of Workers, Methods, and Equipment. The Contractor shall, at all times, employ sufficient labor and equipment for prosecuting the work to full completion in the manner and time required by the contract, plans, and specifications.

All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have sufficient experience in such work and in the operation of the equipment required to perform the work satisfactorily.

Any person employed by the Contractor or by any subcontractor who violates any operational regulations or operational safety requirements and, in the opinion of the ENGINEER, does not perform his work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the ENGINEER, be removed forthwith by the Contractor or subcontractor employing such person, and shall not be employed again in any portion of the work without approval of the ENGINEER.

Should the Contractor fail to remove such persons or person, or fail to furnish suitable and sufficient personnel for the proper execution of the work, the ENGINEER may suspend the work by written notice until compliance with such orders.

All equipment that is proposed to be used on the work shall be of sufficient size and in such mechanical condition as to meet requirements of the work and to produce a satisfactory quality of work. Equipment used on any portion of the work shall be such that no injury to previously completed work, adjacent property, or existing airport facilities will result from its use.

When the methods and equipment to be used by the Contractor in accomplishing the work are not prescribed in the contract, the Contractor is free to use any methods or equipment that will accomplish the work in conformity with the requirements of the contract, plans, and specifications.

When the contract specifies the use of certain methods and equipment, such

methods and equipment shall be used unless others are authorized by the ENGINEER. If the Contractor desires to use a method or type of equipment other than specified in the contract, the Contractor may request authority from the ENGINEER to do so. The request shall be in writing and shall include a full description of the methods and equipment proposed and of the reasons for desiring to make the change. If approval is given, it will be on the condition that the Contractor will be fully responsible for producing work in conformity with contract requirements. If, after trial use of the substituted methods or equipment, the ENGINEER determines that the work produced does not meet contract requirements, the Contractor shall discontinue the use of the substitute method or equipment and shall complete the remaining work with the specified methods and equipment. The Contractor shall remove any deficient work and replace it with work of specified quality, or take such other corrective action as the ENGINEER may direct. No change will be made in basis of payment for the contract items involved nor in contract time as a result of authorizing a change in methods or equipment under this subsection.

80-06 Temporary Suspension of the Work. The OWNER shall have the authority to suspend the work wholly, or in part, for such period or periods as the OWNER may deem necessary, due to unsuitable weather, or such other conditions as are considered unfavorable for the execution of the work, or for such time as is necessary due to the failure on the part of the Contractor to carry out orders given or perform any or all provisions of the contract.

In the event that the Contractor is ordered by the OWNER, in writing, to suspend work for some unforeseen cause not otherwise provided for in the contract and over which the Contractor has no control, the Contractor may be reimbursed for actual money expended on the work during the period of shutdown. No allowance will be made for anticipated profits. The period of shutdown shall be computed from the effective date of the ENGINEER's order to suspend work to the effective date of the ENGINEER's order to resume the work. Claims for such compensation shall be filed with the ENGINEER within the time period stated in the ENGINEER's order to resume work. The Contractor shall submit with his or her claim information substantiating the amount shown on the claim. The ENGINEER will forward the Contractor's claim to the OWNER for consideration in accordance with local laws or ordinances. No provision of this article shall be construed as entitling the Contractor to compensation for delays due to inclement weather, for suspensions made at the request of the OWNER, or for any other delay provided for in the contract, plans, or specifications.

If it should become necessary to suspend work for an indefinite period, the Contractor shall store all materials in such manner that they will not become an obstruction nor become damaged in any way. The Contractor shall take every precaution to prevent damage or deterioration of the work performed and

provide for normal drainage of the work. The Contractor shall erect temporary structures where necessary to provide for traffic on, to, or from the airport.

80-07 Determination and Extension of Contract Time. The number of calendar ~~or working~~ days allowed for completion of the work shall be stated in the proposal and contract and shall be known as the CONTRACT TIME.

Should the contract time require extension for reasons beyond the Contractor's control, it shall be adjusted as follows:

~~**a.** ***Deleted.*** CONTRACT TIME based on WORKING DAYS shall be calculated weekly by the ENGINEER. The ENGINEER will furnish the Contractor a copy of his or her weekly statement of the number of working days charged against the contract time during the week and the number of working days currently specified for completion of the contract (the original contract time plus the number of working days, if any, that have been included in approved CHANGE ORDERS or SUPPLEMENTAL AGREEMENTS covering EXTRA WORK).~~

~~The ENGINEER shall base his or her weekly statement of contract time charged on the following considerations:~~

~~**(1)** No time shall be charged for days on which the Contractor is unable to proceed with the principal item of work under construction at the time for at least six (6) hours with the normal work force employed on such principal item. Should the normal work force be on a double-shift, 12 hours shall be used. Should the normal work force be on a triple-shift, 18 hours shall apply. Conditions beyond the Contractor's control such as strikes, lockouts, unusual delays in transportation, temporary suspension of the principal item of work under construction or temporary suspension of the entire work which have been ordered by the OWNER for reasons not the fault of the Contractor, shall not be charged against the contract time.~~

~~**(2)** The ENGINEER will not make charges against the contract time prior to the effective date of the notice to proceed.~~

~~**(3)** The ENGINEER will begin charges against the contract time on the first working day after the effective date of the notice to proceed.~~

~~**(4)** The ENGINEER will not make charges against the contract time after the date of final acceptance as defined in the subsection 50-15 titled FINAL ACCEPTANCE of Section 50.~~

~~**(5)** The Contractor will be allowed one (1) week in which to file a written~~

~~protest setting forth his or her objections to the ENGINEER's weekly statement. If no objection is filed within such specified time, the weekly statement shall be considered as acceptable to the Contractor.~~

~~The contract time (stated in the proposal) is based on the originally estimated quantities as described in the subsection 20-05 titled INTERPRETATION OF ESTIMATED PROPOSAL QUANTITIES of Section 20. Should the satisfactory completion of the contract require performance of work in greater quantities than those estimated in the proposal, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in contract time shall not consider either the cost of work or the extension of contract time that has been covered by change order or supplemental agreement and shall be made at the time of final payment.~~

b. Contract Time based on calendar days shall consist of the number of calendar days stated in the contract counting from the effective date of the notice to proceed and including all Saturdays, Sundays, holidays, and non-work days. All calendar days elapsing between the effective dates of the OWNER's orders to suspend and resume all work, due to causes not the fault of the Contractor, shall be excluded.

~~At the time of final payment, the contract time shall be increased in the same proportion as the cost of the actually completed quantities bears to the cost of the originally estimated quantities in the proposal. Such increase in the contract time shall not consider either cost of work or the extension of contract time that has been covered by a change order or supplemental agreement. Charges against the contract time will cease as of the date of final acceptance.~~

~~**c.** When the contract time is a specified completion date, it shall be the date on which all contract work shall be substantially complete.~~

If the Contractor finds it impossible for reasons beyond his or her control to complete the work within the contract time as specified, or as extended in accordance with the provisions of this subsection, the Contractor may, at any time prior to the expiration of the contract time as extended, make a written request to the OWNER for an extension of time setting forth the reasons which the Contractor believes will justify the granting of his or her request. Requests for extension of time on calendar day projects, caused by inclement weather, shall be supported with National Weather Bureau data showing the actual amount of inclement weather exceeded what could normally be expected during the contract period. The Contractor's plea that insufficient time was specified is not a valid reason for extension of time. If the supporting

documentation justify the work was delayed because of conditions beyond the control and without the fault of the Contractor, the OWNER may extend the time for completion by a change order that adjusts the contract time or completion date. The extended time for completion shall then be in full force and effect, the same as though it were the original time for completion.

80-08 Failure to Complete on Time. For each calendar day ~~or working day~~, as specified in the contract, that any work remains uncompleted after the contract time (including all extensions and adjustments as provided in the subsection 80-07 titled DETERMINATION AND EXTENSION OF CONTRACT TIME of this Section) the sum specified in the contract and proposal as liquidated damages will be deducted from any money due or to become due the Contractor or his or her surety. Such deducted sums shall not be deducted as a penalty but shall be considered as liquidation of a reasonable portion of damages including but not limited to additional engineering services that will be incurred by the OWNER should the Contractor fail to complete the work in the time provided in their contract.

Liquidated Damages for failure to complete within contract time shall be $1,000.00 (One Thousand Dollars) per Calendar Day.

~~The maximum construction time allowed for Schedules **[ ]** will be the sum of the time allowed for individual schedules but not more than **[ ]** days. Permitting the Contractor to continue and finish the work or any part of it after the time fixed for its completion, or after the date to which the time for completion may have been extended, will in no way operate as a wavier on the part of the OWNER of any of its rights under the contract.~~

80-09 Default and Termination of Contract. The Contractor shall be considered in default of his or her contract and such default will be considered as cause for the OWNER to terminate the contract for any of the following reasons if the Contractor:

a. Fails to begin the work under the contract within the time specified in the Notice to Proceed, or

b. Fails to perform the work or fails to provide sufficient workers, equipment and/or materials to assure completion of work in accordance with the terms of the contract, or

c. Performs the work unsuitably or neglects or refuses to remove materials or to perform anew such work as may be rejected as unacceptable and unsuitable, or

d. Discontinues the execution of the work, or

e. Fails to resume work which has been discontinued within a reasonable time after notice to do so, or

f. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or

g. Allows any final judgment to stand against the Contractor unsatisfied for a period of 10 days, or

h. Makes an assignment for the benefit of creditors, or

i. For any other cause whatsoever, fails to carry on the work in an acceptable manner.

Should the ENGINEER consider the Contractor in default of the contract for any reason above, the ENGINEER shall immediately give written notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the OWNER's intentions to terminate the contract.

If the Contractor or surety, within a period of 10 days after such notice, does not proceed in accordance therewith, then the OWNER will, upon written notification from the ENGINEER of the facts of such delay, neglect, or default and the Contractor's failure to comply with such notice, have full power and authority without violating the contract, to take the execution of the work out of the hands of the Contractor. The OWNER may appropriate or use any or all materials and equipment that have been mobilized for use in the work and are acceptable and may enter into an agreement for the completion of said contract according to the terms and provisions thereof, or use such other methods as in the opinion of the ENGINEER will be required for the completion of said contract in an acceptable manner.

All costs and charges incurred by the OWNER, together with the cost of completing the work under contract, will be deducted from any monies due or which may become due the Contractor. If such expense exceeds the sum which would have been payable under the contract, then the Contractor and the surety shall be liable and shall pay to the OWNER the amount of such excess.

80-10 Termination for National Emergencies. The OWNER shall terminate the contract or portion thereof by written notice when the Contractor is prevented from proceeding with the construction contract as a direct result of an Executive Order of the President with respect to the execution of war or in the interest of national defense.

When the contract, or any portion thereof, is terminated before completion of all items of work in the contract, payment will be made for the actual number of units or items of work completed at the contract price or as mutually agreed for items of work partially completed or not started. No claims or loss of anticipated profits shall be considered.

Reimbursement for organization of the work, and other overhead expenses, (when not otherwise included in the contract) and moving equipment and materials to and from the job will be considered, the intent being that an equitable settlement will be made with the Contractor.

Acceptable materials, obtained or ordered by the Contractor for the work and that are not incorporated in the work shall, at the option of the Contractor, be purchased from the Contractor at actual cost as shown by receipted bills and actual cost records at such points of delivery as may be designated by the ENGINEER.

Termination of the contract or a portion thereof shall neither relieve the Contractor of his or her responsibilities for the completed work nor shall it relieve his or her surety of its obligation for and concerning any just claim arising out of the work performed.

80-11 Work Area, Storage Area and Sequence of Operations. The Contractor shall obtain approval from the ENGINEER prior to beginning any work in all areas of the airport. No operating runway, taxiway, or air operations area (AOA) shall be crossed, entered, or obstructed while it is operational. The Contractor shall plan and coordinate his or her work in such a manner as to ensure safety and a minimum of hindrance to flight operations. All Contractor equipment and material stockpiles shall be stored a minimum of 700 feet from the centerline of an active runway. No equipment will be allowed to park within the approach area of an active runway at any time. No equipment shall be within 500 feet of an active runway at any time.

END OF SECTION 80

SECTION 90

MEASUREMENT AND PAYMENT

90-01 Measurement of Quantities. ~~All~~ *Any unit price* work completed under the contract will be measured by the ENGINEER, or his or her authorized representatives, using United States Customary Units of Measurement or the International System of Units.

The method of measurement and computations to be used in determination of quantities of material furnished and of work performed under the contract will be those methods generally recognized as conforming to good engineering practice.

Unless otherwise specified, longitudinal measurements for area computations will be made horizontally, and no deductions will be made for individual fixtures (or leave-outs) having an area of 9 square feet or less. Unless otherwise specified, transverse measurements for area computations will be the neat dimensions shown on the plans or ordered in writing by the ENGINEER.

Structures will be measured according to neat lines shown on the plans or as altered to fit field conditions.

Unless otherwise specified, all contract items which are measured by the linear foot such as electrical ducts, conduits, pipe culverts, underdrains, and similar items shall be measured parallel to the base or foundation upon which such items are placed.

In computing volumes of excavation the average end area method or other acceptable methods will be used.

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fraction of inch.

The term “ton” will mean the short ton consisting of 2,000 lb avoirdupois. All materials that are measured or proportioned by weights shall be weighed on accurate, approved scales by competent, qualified personnel at locations designed by the ENGINEER. If material is shipped by rail, the car weight may be accepted provided that only the actual weight of material is paid for. However, car weights will not be acceptable for material to be passed through mixing plants. Trucks used to haul material being paid for by weight shall be weighed empty daily at such times as the ENGINEER directs, and each truck shall bear a plainly legible identification mark.

Materials to be measured by volume in the hauling vehicle shall be hauled in approved vehicles and measured therein at the point of delivery. Vehicles for this purpose may be of any size or type acceptable for the materials hauled, provided that the body is of such shape that the actual contents may be readily and accurately determined. All vehicles shall be loaded to at least their water level capacity, and all loads shall be leveled when the vehicles arrive at the point of delivery.

When requested by the Contractor and approved by the ENGINEER in writing, material specified to be measured by the cubic yard may be weighed, and such weights will be converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the ENGINEER and shall be agreed to by the Contractor before such method of measurement of pay quantities is used.

Bituminous materials will be measured by the gallon or ton. When measured by volume, such volumes will be measured at 60°F or will be corrected to the volume at 60°F using ASTM D1250 for asphalts or ASTM D633 for tars.

Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when bituminous material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.

When bituminous materials are shipped by truck or transport, net certified weights by volume, subject to correction for loss or foaming, may be used for computing quantities.

Cement will be measured by the ton or hundredweight.

Timber will be measured by the thousand feet board measure (MFBM) actually incorporated in the structure. Measurement will be based on nominal widths and thicknesses and the extreme length of each piece.

The term “lump sum” when used as an item of payment will mean complete payment for the work described in the contract.

When a complete structure or structural unit (in effect, “lump sum” work) is specified as the unit of measurement, the unit will be construed to include all necessary fittings and accessories.

Rental of equipment will be measured by time in hours of actual working time and necessary traveling time of the equipment within the limits of the work. Special equipment ordered by the ENGINEER in connection with force account work will be measured as agreed in the change order or supplemental

agreement authorizing such force account work as provided in the subsection 90-05 titled PAYMENT FOR EXTRA WORK of this section.

When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerances in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

Scales for weighing materials which are required to be proportioned or measured and paid for by weight shall be furnished, erected, and maintained by the Contractor, or be certified permanently installed commercial scales.

Scales shall be accurate within 1/2% of the correct weight throughout the range of use. The Contractor shall have the scales checked under the observation of the inspector before beginning work and at such other times as requested. The intervals shall be uniform in spacing throughout the graduated or marked length of the beam or dial and shall not exceed one-tenth of 1% of the nominal rated capacity of the scale, but not less than 1 pound. The use of spring balances will not be permitted.

Beams, dials, platforms, and other scale equipment shall be so arranged that the operator and the inspector can safely and conveniently view them.

Scale installations shall have available ten standard 50-pound weights for testing the weighing equipment or suitable weights and devices for other approved equipment.

Scales must be tested for accuracy and serviced before use at a new site. Platform scales shall be installed and maintained with the platform level and rigid bulkheads at each end.

Scales “overweighing” (indicating more than correct weight) will not be permitted to operate, and all materials received subsequent to the last previous correct weighting-accuracy test will be reduced by the percentage of error in excess of one-half of 1%.

In the event inspection reveals the scales have been underweighing (indicating less than correct weight), they shall be adjusted, and no additional payment to the Contractor will be allowed for materials previously weighed and recorded.

All costs in connection with furnishing, installing, certifying, testing, and maintaining scales; for furnishing check weights and scale house; and for all other items specified in this subsection, for the weighing of materials for

proportioning or payment, shall be included in the unit contract prices for the various items of the project.

When the estimated quantities for a specific portion of the work are designated as the pay quantities in the contract, they shall be the final quantities for which payment for such specific portion of the work will be made, unless the dimensions of said portions of the work shown on the plans are revised by the ENGINEER. If revised dimensions result in an increase or decrease in the quantities of such work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

90-02 Scope of Payment. The Contractor shall receive and accept compensation provided for in the contract as full payment for furnishing all materials, for performing all work under the contract in a complete and acceptable manner, and for all risk, loss, damage, or expense of whatever character arising out of the nature of the work or the execution thereof, subject to the provisions of the subsection 70-18 titled NO WAIVER OF LEGAL RIGHTS of Section 70.

When the “basis of payment” subsection of a technical specification requires that the contract price (price bid) include compensation for certain work or material essential to the item, this same work or material will not also be measured for payment under any other contract item which may appear elsewhere in the contract, plans, or specifications.

90-03 Compensation for Altered Quantities. When the accepted quantities of work vary from the quantities in the proposal, the Contractor shall accept as payment in full, so far as contract items are concerned, payment at the original contract price for the accepted quantities of work actually completed and accepted. No allowance, except as provided for in the subsection 40-02 titled ALTERATION OF WORK AND QUANTITIES of Section 40 will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor which results directly from such alterations or indirectly from his or her unbalanced allocation of overhead and profit among the contract items, or from any other cause.

90-04 Payment for Omitted Items. As specified in the subsection 40-03 titled OMITTED ITEMS of Section 40, the ENGINEER shall have the right to omit from the work (order nonperformance) any contract item, except major contract items, in the best interest of the OWNER.

Should the ENGINEER omit or order nonperformance of a contract item or portion of such item from the work, the Contractor shall accept payment in full at the contract prices *or as agreed by change order* for any work actually completed and acceptable prior to the ENGINEER’s order to omit or non-perform such contract item.

Acceptable materials ordered by the Contractor or delivered on the work prior to the date of the ENGINEER's order will be paid for at the actual cost to the Contractor and shall thereupon become the property of the OWNER.

In addition to the reimbursement hereinbefore provided, the Contractor shall be reimbursed for all actual costs incurred for the purpose of performing the omitted contract item prior to the date of the ENGINEER's order. Such additional costs incurred by the Contractor must be directly related to the deleted contract item and shall be supported by certified statements by the Contractor as to the nature the amount of such costs.

90-05 Payment for Extra Work. Extra work, performed in accordance with the subsection 40-04 titled EXTRA WORK of Section 40, will be paid for at the contract prices or agreed prices specified in the change order or supplemental agreement authorizing the extra work.

90-06 Partial Payments. Partial payments will be made to the Contractor ~~at least~~ once each month as the work progresses. Said payments will be based upon estimates, prepared by the *Contractor* ~~ENGINEER~~, of the value of the work performed and materials complete and in place, in accordance with the contract, plans, and specifications. Such partial payments may also include the delivered actual cost of those materials stockpiled and stored in accordance with the subsection 90-07 titled PAYMENT FOR MATERIALS ON HAND of this section. No partial payment will be made when the amount due to the Contractor since the last estimate amounts to less than five hundred dollars.

The Contractor is required to pay all subcontractors for satisfactory performance of their contracts no later than 30 days after the Contractor has received a partial payment. The OWNER must ensure prompt and full payment of retainage from the prime Contractor to the subcontractor within 30 days after the subcontractor's work is satisfactorily completed. A subcontractor's work is satisfactorily completed when all the tasks called for in the subcontract have been accomplished and documented as required by the OWNER. When the OWNER has made an incremental acceptance of a portion of a prime contract, the work of a subcontractor covered by that acceptance is deemed to be satisfactorily completed.

From the total of the amount determined to be payable on a partial payment, five (5) percent of such total amount will be deducted and retained by the OWNER until the final payment is made, except as may be provided (at the Contractor's option) in the subsection 90-08 titled PAYMENT OF WITHHELD FUNDS of this section. The balance (ninety-five (95) percent) of the amount payable, less all previous payments, shall be certified for payment. Should the Contractor exercise his or her option, as provided in the subsection 90-08 titled

PAYMENT OF WITHHELD FUNDS of this section, no such percent retainage shall be deducted.

When at least 95% of the work has been completed, the ENGINEER shall, at the OWNER's discretion and with the consent of the surety, prepare estimates of both the contract value and the cost of the remaining work to be done.

The OWNER may retain an amount not less than twice the contract value or estimated cost, whichever is greater, of the work remaining to be done. The remainder, less all previous payments and deductions, will then be certified for payment to the Contractor.

It is understood and agreed that the Contractor shall not be entitled to demand or receive partial payment based ~~on quantities~~ ~~of~~ work in excess of *that* ~~those~~ provided in the proposal or covered by approved change orders or supplemental agreements. ~~except when such excess quantities have been determined by the ENGINEER to be a part of the final quantity for the item of work in question~~.

No partial payment shall bind the OWNER to the acceptance of any materials or work in place as to quality or quantity. All partial payments are subject to correction at the time of final payment as provided in the subsection 90-09 titled ACCEPTANCE AND FINAL PAYMENT of this section.

The Contractor shall deliver to the OWNER a complete release of all claims for labor and material arising out of this contract before the final payment is made. If any subcontractor or supplier fails to furnish such a release in full, the Contractor may furnish a bond or other collateral satisfactory to the OWNER to indemnify the OWNER against any potential lien or other such claim. The bond or collateral shall include all costs, expenses, and attorney fees the OWNER may be compelled to pay in discharging any such lien or claim.

90-07 Payment for Materials on Hand. Partial payments may be made to the extent of the delivered cost of materials to be incorporated in the work, provided that such materials meet the requirements of the contract, plans, and specifications and are delivered to acceptable sites on the airport property or at other sites in the vicinity that are acceptable to the OWNER. Such delivered costs of stored or stockpiled materials may be included in the next partial payment after the following conditions are met:

a. The material has been stored or stockpiled in a manner acceptable to the ENGINEER at or on an approved site.

b. The Contractor has furnished the ENGINEER with acceptable evidence of the quantity and quality of such stored or stockpiled materials.

c. The Contractor has furnished the ENGINEER with satisfactory evidence that the material and transportation costs have been paid.

d. The Contractor has furnished the OWNER legal title (free of liens or encumbrances of any kind) to the material so stored or stockpiled.

e. The Contractor has furnished the OWNER evidence that the material so stored or stockpiled is insured against loss by damage to or disappearance of such materials at any time prior to use in the work.

It is understood and agreed that the transfer of title and the OWNER's payment for such stored or stockpiled materials shall in no way relieve the Contractor of his or her responsibility for furnishing and placing such materials in accordance with the requirements of the contract, plans, and specifications.

In no case will the amount of partial payments for materials on hand exceed the contract price for such materials or the contract price for the contract item in which the material is intended to be used.

No partial payment will be made for stored or stockpiled living or perishable plant materials.

The Contractor shall bear all costs associated with the partial payment of stored or stockpiled materials in accordance with the provisions of this subsection.

90-08 Payment of Withheld Funds. At the Contractor's option, if an OWNER withholds retainage in accordance with the methods described in subsection 90-06 PARTIAL PAYMENTS, the Contractor may request that the OWNER deposit the retainage into an escrow account. The OWNER's deposit of retainage into an escrow account is subject to the following conditions:

a. The Contractor shall bear all expenses of establishing and maintaining an escrow account and escrow agreement acceptable to the OWNER.

b. The Contractor shall deposit to and maintain in such escrow only those securities or bank certificates of deposit as are acceptable to the OWNER and having a value not less than the retainage that would otherwise be withheld from partial payment.

c. The Contractor shall enter into an escrow agreement satisfactory to the OWNER.

d. The Contractor shall obtain the written consent of the surety to such agreement.

90-09 Acceptance and Final Payment. When the contract work has been accepted in accordance with the requirements of the subsection 50-15 titled FINAL ACCEPTANCE of Section 50, the ENGINEER will prepare *a statement of the final contract price including all prior change orders and supplemental agreements, and any final change order items.* ~~the final estimate of the items of work actually performed.~~ The Contractor shall approve the ENGINEER's final ~~estimate~~ *statement* or advise the ENGINEER of the Contractor's objections. ~~to the final estimate which are based on disputes in measurements or computations of the final quantities to be paid under the contract as amended by change order or supplemental agreement~~. The Contractor and the ENGINEER shall resolve all disputes (if any) ~~in the measurement and computation of final quantities to be paid~~ within 30 calendar days of the Contractor's receipt of the ENGINEER's final ~~estimate~~ *statement*. If, after such 30-day period, a dispute still exists, the Contractor may approve the ENGINEER's *final contract price* ~~estimate~~ under protest of the *amount* ~~quantities~~ in dispute, and such disputed *amount* ~~quantities~~ shall be considered by the OWNER as a claim in accordance with the subsection 50-16 titled CLAIMS FOR ADJUSTMENT AND DISPUTES of Section 50.

After the Contractor has approved, or approved under protest, the ENGINEER's final estimate, and after the ENGINEER's receipt of the project closeout documentation required in subsection 90-11 Project Closeout, final payment will be processed based on the entire sum, or the undisputed sum in case of approval under protest, determined to be due the Contractor less all previous payments and all amounts to be deducted under the provisions of the contract. All prior partial estimates and payments shall be subject to correction in the final estimate and payment.

If the Contractor has filed a claim for additional compensation under the provisions of the subsection 50-16 titled CLAIMS FOR ADJUSTMENTS AND DISPUTES of Section 50 or under the provisions of this subsection, such claims will be considered by the OWNER in accordance with local laws or ordinances. Upon final adjudication of such claims, any additional payment determined to be due the Contractor will be paid pursuant to a supplemental final estimate.

90-10 Construction Warranty.

a. In addition to any other warranties in this contract, the Contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, workmanship, or design furnished, or performed by the Contractor or any subcontractor or supplier at any tier.

b. This warranty shall continue for a period of one year from the date of final acceptance of the work. If the OWNER takes possession of any part of the work before final acceptance, this warranty shall continue for a period of one year from the date the OWNER takes possession. However, this will not relieve the Contractor from corrective items required by the final acceptance of the project work.

c. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to OWNER real or personal property, when that damage is the result of:

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defect of equipment, material, workmanship, or design furnished by the Contractor.

d. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for one year from the date of repair or replacement.

e. The OWNER will notify the Contractor, in writing, within **[seven (7)]** days after the discovery of any failure, defect, or damage.

f. If the Contractor fails to remedy any failure, defect, or damage within **[14]** days after receipt of notice, the OWNER shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

g. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall: (1) Obtain all warranties that would be given in normal commercial practice; (2) Require all warranties to be executed, in writing, for the benefit of the OWNER, as directed by the OWNER, and (3) Enforce all warranties for the benefit of the OWNER.

h. This warranty shall not limit the OWNER's rights with respect to latent defects, gross mistakes, or fraud.

90-11 Project Closeout. Approval of final payment to the Contractor is contingent upon completion and submittal of the items listed below. The final payment will not be approved until the ENGINEER approves the Contractor's final submittal. The Contractor shall:

a. Provide two (2) copies of all manufacturers warranties specified for materials, equipment, and installations.

b. Provide weekly payroll records (not previously received) from the general Contractor and all subcontractors.

c. Complete final cleanup in accordance with subsection 40-08, FINAL CLEANUP.

d. Complete all punch list items identified during the Final Inspection.

e. Provide complete release of all claims for labor and material arising out of the Contract.

f. Provide a certified statement signed by the subcontractors, indicating actual amounts paid to the Disadvantaged Business Enterprise (DBE) subcontractors and/or suppliers associated with the project.

g. When applicable per state requirements, return copies of sales tax completion forms.

h. Manufacturer's certifications for all items incorporated in the work.

i. All required record drawings, as-built drawings or as-constructed drawings.

j. Project Operation and Maintenance (O&M) Manual.

k. Security for Construction Warranty.

l. Equipment commissioning documentation submitted, if required.

END OF SECTION 90

SECTION 012100 - ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.
2. Include defined costs associated with allowances in base bid.

B. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices.

1.2 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.3 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.4 QUANTITY ALLOWANCES

A. Quantity Allowance: An estimated quantity or extent of a product, assembly, or portion of the Work that cannot be measured prior to construction, but is reasonably anticipated.

B. All costs for performing the work described under the quantity allowance are included in the allowance. These costs include materials, delivery, installation, taxes, insurance, equipment rental, and similar costs, and Contractor's overhead and profit.

C. When work is performed and actual quantity or extent is measured, the Contract Sum will be adjusted by Change Order based on Unit Cost indicated in the Agreement.

1.5 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.

4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

C. Unused amounts of moneys that define the value of the allowances, included integrally in the work and materials allowances, shall be credited to the Owner by deduct change order prior to approval of Final Application for Payment.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

B. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.2 SCHEDULE OF ALLOWANCES

A. Allowance No. 1: Include **$100,000.00** for BHS Spare Parts.

1. Allowance to be included in BHS System Pricing Schedule.

END OF SECTION 012100

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.2 DEFINITIONS

A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

B. Unsuitable Soil Removal and Replacement:

1. The term "cubic yards" shall be defined as cubic yards of undisturbed material in-place. Under no conditions will the term "cubic yard" refer to "loose", "truck" or "disturbed" material.
2. Soil removal, soil replacement, and other earthwork indicated on the Drawings shall be included in the Base Bid. Unit costs shall be used to calculate costs for unanticipated soil replacement in excess of the Scope of Work indicated on Drawings.
    a. All soil replacement is unclassified.
3. Replacement of unsuitable soil is defined as including:
    a. Excavation of unsuitable material by mechanical means.
    b. Disposal of unsuitable material off-site.
    c. Supply of new satisfactory material acceptable to the Engineer from off site. Refer to Earthwork specifications for description of satisfactory backfill material.
    d. Installation of new material including compaction as required by Division 02.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1:

1. Description: Unsuitable soil removal and disposal and placement and compaction of new satisfactory fill.
2. Unit of Measurement: Cubic Yard.

B. Unit Price No. 2:

1. Description: Unsuitable soil removal and disposal and placement and compaction of No. 57 stone.
2. Unit of Measurement: Cubic Yard.

END OF SECTION 012200

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate 1: In lieu of sheet steel catwalks, state the amount (cost difference) to be added to the base bid to provide open steel grating catwalks.

B. Alternate No. 2: In lieu of manufacturers specified as base bid, state the amount (cost difference) to be added to the base bid to provide Door Hardware Locksets by Best (no substitutions), as indicated on Drawings and described in Specifications.

C. Alternate No. 3: In lieu of manufacturers specified as base bid, state the amount (cost difference) to be added to the base bid to provide Carpet Tile by Shaw (no substitutions), as indicated on Drawings and described in Specifications.

D. Alternate No. 4: In lieu of manufacturers specified as base bid, state the amount (cost difference) to be added to the base bid to provide Direct Digital Control (DDC) Energy Management and Building Automation System (BAS) by Honeywell (no substitutions), as indicated on Drawings and described in Specifications.

E. Alternate No. 5: In lieu of manufacturers specified as base bid, state the amount (cost difference) to be added to the base bid to provide Closed-Circuit Television (CCTV) Surveillance System by Johnson Controls (no substitutions), as indicated on Drawings and described in Specifications.

F. Alternate No. 6: In lieu of manufacturers specified as base bid, state the amount (cost difference) to be added to the base bid to provide Public Address System by MOOD Media (no substitutions), as indicated on Drawings and described in Specifications.

G. Alternate No. 7: In lieu of manufacturers specified as base bid, state the amount (cost difference) to be added to the base bid to provide Access Control System by Johnson Controls (no substitutions), as indicated on Drawings and described in Specifications.

H. Alternate No. 8: In lieu of manufacturers specified as base bid, state the amount (cost difference) to be added to the base bid to provide Intelligent Fire Alarm Detection System and Integrated Digital Audio by Notifier (no substitutions), as indicated on Drawings and described in Specifications.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Section:

1. Document "Instructions to Bidders" for timing of substitution requests and outline of substitution procedures during bidding.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor that are not required in order to meet other Project requirements but may offer advantage to Owner.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit one copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form included at the end of this Section.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
d. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

1) Contractor shall provide a marked-up specification section to provide a point-by-point comparison between the specified product and the proposed substitution. The point-by-point comparison shall indicate each point of compliance, non-compliance, and variance between the specified and proposed product.

e. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
f. Evidence that proposed product provides specified warranty.
g. Samples, where applicable or requested.

h. Certificates and qualification data, where applicable or requested.
i. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
j. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
k. Research reports evidencing compliance with building code in effect for Project.
l. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
m. Cost information, including a proposal of change, if any, in the Contract Sum.
n. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
o. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 14 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance:

1) During Bidding: Addendum.
2) During Construction: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 COORDINATION

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions During Bidding: Refer to Instructions to Bidders for timing of substitution requests and outline of substitution procedures during bidding.

B. Substitutions for Cause During Construction:

1. Requests for substitution following award of contract must comply with requirements of this article and are restricted to those necessitated by the following circumstances:

a. Specified product is no longer available for purchase.
b. Specified product is not available within schedule requirements of project.
c. Specified product is not compatible with other product approved for project.

d. Specified warranty is not available from any manufacturer.

C. Substitutions, General:

1. Requests that do not include the completed form, including point-by-point comparison, and authorized signature will not be reviewed.
2. Include sufficient data with request so that direct comparison of proposed item to specified item can be made. Knowledge and experience of applicator and warranty may be an integral part of specification. Provide data applicator/installer qualifications, such as experience, organizations, references, projects, and dates.
3. Verify that submitted product meets requirements indicated before submitting request, and note any deviations. Inadequate warranty, vagueness of submittal, failure to meet project requirements, or insufficient data may be cause for disapproval of request. Architect's rejection of requested substitution is final, and does not require documentation or further justification. Architect's approval is subject to reconsideration at any time in life of Contract, if evidence is later discovered that proposed substitution is incompatible or fails to comply with indicated performance or other requirements.
4. Approvals are based upon the opinion, knowledge, information, and belief of the Architect at time of issuance of approval and reliance upon data submitted. Approvals are subject to reconsideration as additional data, materials, workmanship, and coordination with other work are observed and reviewed. In proposing items for approval, Bidder/Contractor assumes all risks, costs, and responsibilities for product's acceptance by authorities having jurisdiction, integration into Work, and performance.

D. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Requested substitution will not adversely affect Contractor's construction schedule.
c. Requested substitution has received necessary approvals of authorities having jurisdiction.
d. Requested substitution is compatible with other portions of the Work.
e. Requested substitution has been coordinated with other portions of the Work.
f. Requested substitution provides specified warranty.
g. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

E. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

CONTRACTOR'S REQUEST FOR SUBSTITUTION FORM

Project:	ILM Terminal Improvements - Contract 2	Project No.:	9202-000
To:	The Wilson Group	Specification Section #:	
	Charlotte, NC 28205	Contractor:	
Attn.:	Travis Pence, AIA	Requested by:	
Phone:	704-331-9747	Phone:	
Fax:	704-331-9748	Fax:	
Email:	travis@twgarchitects.com	Email:	

Reason for not providing specified item:

Savings to Owner for accepting substitution:

Specified Product/Fabrication Method
(List name/description; model no.; manufacturer):

Required Information for *Specified* Product:	Attached:
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Fabrication Drawings	☐
Samples (Where Applicable)	☐

Proposed Product/Fabrication Method
(List trade name/description; model no.; manufacturer):

Required Information for *Proposed* Product:	Attached:
Point by Point Comparative Product Data	☐ (Required)
Tests	☐
Reports	☐
Fabrication Drawings	☐
Samples (Where Applicable)	☐

List of Related Changes/Modifications:

Differences between proposed substitution
and specified product:

Does proposed product/fabrication method affects other parts of the Work? ☐ No ☐ Yes: Explain _____

_____

_____

Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product as utilized for this project, except as noted herein.
- Qualifications of manufacturer, installer, and other specified parties meet the specified qualifications.
- Same special warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source for replacement parts, as applicable, is available as that specified.
- Proposed substitution does not affect dimensions and functional clearances, except as noted herein.
- Proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
- Failure of proposed substitution to produce indicated results will not be considered grounds for additional payment or time.

For the Contractor:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

Fax: _____

Email: _____

For the Manufacturer:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

Fax: _____

Email: _____

END OF CONTRACTOR'S REQUEST FOR SUBSTITUTION FORM

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
        1) Excavation Related Changes: Contractor shall coordinate with Owner's testing agency to determine in-place quantities of undisturbed material for changes in the Work relating to soil removal, hauling, disposal and/or placement. Loose, truck, or disturbed material measurements are not acceptable. Claims for quantities not verified by the testing agency are subject to rejection by the Owner.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    a. Excavation Related Changes: Contractor shall coordinate with Owner's testing agency to determine in-place quantities of undisturbed material for changes in the Work relating to soil removal, hauling, disposal and/or placement. Loose, truck, or disturbed material

measurements are not acceptable. Claims for quantities not verified by the testing agency are subject to rejection by the Owner.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

C. Change Proposal Form: Use form included in Project Manual.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

B. The cost of the Contractors overhead and profit on any change order shall be:

1. For extra Work completed by the Contractor with his own labor, not more than 15 percent shall be added as the allowance for overhead and profit.
2. For extra Work completed by Subcontractors of the Contractor, not more than 10 percent shall be added as the allowance for overhead and profit.
3. For Work deleted which would have been completed by the Contractor, with his own labor, not less than 10 percent shall be credited to the Owner as the allowance for overhead and profit.
4. For Work deleted which would have been completed by Subcontractors of the Contractor, not less than 5 percent shall be credited to the Owner by the Contractor as the allowance for overhead and profit.

C. In order to facilitate checking of quotations for extras or credits, proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 EXTENSION OF TIME DUE TO WEATHER

A. General: The intention of this article is to establish the procedure for amending the Contract Time when excess adverse weather conditions have repeatedly caused cancellation of scheduled critical activities, resulting in delay to the Project.

B. Definitions:

1. Adverse Weather: Job site environmental conditions in which precipitation, or soil conditions resulting from precipitation, or ambient temperature conditions during working hours preclude carrying out a Scheduled Critical Activity. The following conditions may be considered by the Architect in determining the extent of excess adverse weather conditions, depending upon the nature of the delayed project tasks:

   a. Precipitation greater than 0.1 inch of water equivalent per day.
   b. Days on which the average air temperature does not exceed 32 degrees F.
   c. Other weather conditions deemed hazardous by the Contractor.

2. Scheduled Critical Activity: Project tasks, the delay of which will directly result in a delay in the completion of the project.
3. Excess Adverse Weather: Adverse weather occurring in excess of the normal, cumulative number of calendar days of adverse weather as listed below:

   a. January - 6
   b. February - 6
   c. March - 7
   d. April - 7
   e. May - 7
   f. June - 7
   g. July - 9
   h. August - 8
   i. September - 7
   j. October - 5
   k. November - 5
   l. December - 7

C. Claim for Extension of Time Due to Weather:

1. Contractor shall file claim utilizing the form provided at the end of this Section for each month during which adverse weather occurs.

   a. Attach copies of Contractor's Daily Reports for each day of adverse weather, describing fully the weather conditions, scheduled activities delayed, and reasons for the delay.
   b. Include photographs where applicable for documenting soil conditions.
   c. Attach copy of NCDC/NOAA Local Climatological Data report for given month, or other published U.S. or state monthly weather data acceptable to Architect.

2. Claim shall be filed for a calendar month by attaching the completed form to the Application for Payment submitted the following month.
3. Architect shall review and approve or take other action upon Contractor's Claim for Extension of Time. Adjustment of Contract Time shall be made by a single Change Order prepared at project closeout.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

CHANGE PROPOSAL WORKSHEET SUMMARY

ILM Terminal Improvements - Contract 2 — New Hanover County Airport Authority, Owner
The Wilson Group: 9202-000 — Contract Document Date: _____, 20___
Bulletin No. ____, Date: _____, 20___

A. NOTICE TO CONTRACTOR

1. Use this form as a cover sheet and summary for costs associated with Construction Change Directives, Requests for Proposal, and Change Orders. Use one form for Contractor, and a form for each subcontractor. Indicate allowable overhead and profit for Contractor, subcontractors, and sub-subcontractors in accordance with the Conditions of the Contract.

B. MATERIALS

1. Direct Cost of Materials $_____
   a) Attach list with quantity, item, unit cost, unit manhours, total manhours, OT manhours, total cost.
2. Overhead and Profit on Item B.1. $_____
   a) Include __% max. for small tools & consumables
3. Sales Tax $_____
4. Shipping and Transportation $_____
5. Materials Subtotal $_____

C. LABOR

1. Direct Cost of Labor: Hours: _____ @ _____ /hr. $_____
   a) Include time sheets if requested.
2. Overhead and Profit on Item C.1. $_____
   a) Show O & P percentage on straight labor cost, not on premium portion.
   b) O & P includes supervisor's time.
3. Payroll Taxes and Insurance @ _____ % $_____
4. Labor Subtotal $_____

D. EQUIPMENT RENTAL

1. Equipment Rental $_____
   a) Include quotes and pick-up/delivery tickets.
2. Overhead and Profit on Item D.1. (__% maximum) $_____
3. Equipment Rental Subtotal $_____

E. SUBCONTRACTORS

1. Subcontractors $_____
   a) Include quotes with material and equipment back up
2. Overhead and Profit on Item E.1. (__% maximum) $_____
3. Subcontractor Subtotal $_____

F. SUBTOTAL OF PROPOSAL $_____

1. Bonds (___% of Subtotal of Proposal) $_____

G. TOTAL OF CHANGE PROPOSAL $_____

CHANGE PROPOSAL WORKSHEET SUMMARY

H. TIME EXTENSION REQUEST:

1. Number of Days: _____ Schedule Activity # Affected: _____
2. Number of Days: _____ Schedule Activity # Affected: _____
3. Number of Days: _____ Schedule Activity # Affected: _____
4. Total Number of Days, this Proposal: _____

I. CONTRACTOR'S SIGNATURE:

1. Contractor: _____
   Company Name
2. Prepared By: _____
   Name
3. Date: _____

J. ATTACHMENTS:

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

    a. Application for Payment forms with continuation sheets.
    b. Submittal schedule.
    c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual Table of Contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange schedule of values consistent with format of AIA Document G703 with each item listing value of labor and material.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Description of the Work.
    b. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

        1) Labor.
        2) Materials.
        3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

    a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.

6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

1. Submit draft copy of Application for Payment prior to due date for review by Architect.
2. Pay applications not submitted on time will not be paid until the following month.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders after all signatures are executed.
4. Provide Sales and Use Tax Report with each Application for Payment.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.

c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit five signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: Owner reserves the right to require waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Products list (preliminary if not final).
5. Submittal schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of building permits.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.
13. Performance and payment bonds.
14. Data needed to acquire Owner's insurance.

I. Retainage Reduction: Until the Work is 50 percent complete, the Owner shall pay 95 percent of the amount due to the Contractor on account of progress payments. At the time the Work is 50 percent complete and thereafter, the Contractor shall submit, for Owner's and Architect's review and approval a written request for retainage reduction. Upon Owner's approval, with written consent of the surety, the Architect may certify remaining partial payments to be paid in full.

1. The Contractor, as a condition precedent to retainage reduction, shall submit for review and approval by the Architect the required Operation and Maintenance Manuals.

J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. Prior to Substantial Completion of the work, the Contractor shall transmit the record set of Contract Documents to the Architect along with a typed list of each change or revision made

during construction of the project. This list shall include change order numbers, authorization dates, and other information relevant to each change. Record Drawings must be received and approved prior to issuance of Final Payment.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. Coordination drawings.
2. Administrative and supervisory personnel.
3. Requests for Information (RFIs).
4. Project information management system.
5. Project meetings.

1.2 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Prior to starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project. Keep list current at all times.

1.3 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to assure proper performance of components where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

1.4 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to the following requirements:

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   e. Indicate required installation sequences.
   f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

2. Review: Architect will review coordination drawings to verify that components requiring coordination have been included, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.
3. Coordination Drawing Format: Prepare coordination drawings according to requirements in Section 013300 "Submittal Procedures" for Shop Drawings and post to Project Information Management System.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
    a. Runs of vertical and horizontal conduit 1-1/4-inch diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
    c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Fire-Protection System: Show the following:
    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.5 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI via the Project Information Management System.
1. Architect will not respond to RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form via the Project Information Management System.

1. Attachments shall be electronic files in Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow five working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will not be reviewed:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. RFI Log: The Project Information Management System will create and maintain the RFI log.

F. On receipt of Architect's action, immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

1.6 WEB-BASED PROJECT INFORMATION MANAGEMENT SYSTEM

A. The Architect has established a web-based Project Information Management System to facilitate communication and record-keeping during the project. Architect will provide access to Contractor's key personnel. Refer to www.NewForma.com.

1. Use Architect's web-based Project Information Management System for purposes of managing project communication and documentation until Final Completion.
2. Due to the size restrictions on email communication, all electronic files must be submitted through NewForma. Architect assumes no responsibility for information not received by Contractor's failure to use NewForma and such loss or delay of information will not be considered as a delay claim.

B. Project Information Management System shall include the following functions:

1. Project directory.
2. Project correspondence.
3. Meeting minutes.
4. Contract modifications forms and logs.
5. RFI forms and logs.
6. Submittals forms and logs.
7. Reminder and tracking functions.
8. Task and issue management.
9. Photo documentation.
10. Schedule and calendar management.
11. Payment application forms.
12. Drawing and specification document hosting, viewing, and updating.

13. Online document collaboration.
14. Archiving functions.

C. Contractor, subcontractors, and other parties granted access by Contractor to Project Information Management System shall execute a data licensing agreement in the form of Agreement included in this Project Manual.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record discussions and agreements achieved. Distribute the meeting minutes to attendees, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner, Architect, and Contractor.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Critical work sequencing and long-lead items.
c. Designation of key personnel and their duties.
d. Procedures for processing field decisions and Change Orders.
e. Procedures for RFIs.
f. Procedures for testing and inspecting.
g. Procedures for processing Applications for Payment.
h. Distribution of the Contract Documents.
i. Submittal procedures.
j. Preparation of record documents.
k. Use of the premises.
l. Work restrictions and work hours.
m. Owner's occupancy requirements.
n. Responsibility for temporary facilities and controls.
o. Procedures for moisture and mold control.
p. Procedures for disruptions and shutdowns.
q. Construction waste management and recycling.
r. Parking availability.
s. Office, work, and storage areas.
t. Equipment deliveries and priorities.
u. First aid.
v. Security.
w. Progress cleaning.
x. Bonds and insurance.

3. Minutes: Architect will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs and change orders.
    d. Purchases, deliveries and submittals.
    e. Review of mockups.
    f. Possible conflicts and material compatibility problems.
    g. Time schedules and weather limitations.
    h. Manufacturer's written instructions.
    i. Warranty requirements.
    j. Acceptability of substrates.
    k. Temporary facilities and controls.
    l. Space and access limitations.
    m. Regulations of authorities having jurisdiction.
    n. Testing and inspecting requirements.
    o. Installation procedures.
    p. Coordination with other work.
    q. Required performance results.
    r. Protection of construction, personnel, and adjacent work.

3. Record conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Architect will conduct progress meetings at monthly intervals.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Coordinate dates of meetings with preparation of payment requests.
3. Status Report: Contractor shall provide written report outlining the following:

    a. Work done in last 30 days.
    b. Work scheduled for next 30 days.
    c. RFI status.
    d. Submittal status.
    e. Allowance recap.
    f. Pre-Installation meetings scheduled.
    g. Narrative of progress schedule status.

4. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule

revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals, material deliveries, and off-site fabrication.
4) Site access and utilization.
5) Temporary facilities and controls.
6) Progress cleaning.
7) Quality and work standards.
8) Status of correction of deficient items.
9) Field observations.
10) Status of RFIs.
11) Status of proposal requests and pending changes.
12) Status of Change Orders.
13) Pending claims and disputes.
14) Documentation of information for payment requests.

5. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Coordination Meetings: Conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.

8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

E. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.

2. PDF electronic file.

B. Startup construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Initial schedule shall be submitted with signatures of prime subcontractors, indicating their acceptance of schedule.
2. Submit a working electronic copy of schedule, labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at monthly intervals.

G. Site Condition Reports: Submit at time of discovery of differing conditions.

H. Special Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
2. The Contractor shall conduct his operations so the completion date in the Agreement is met.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Concrete Slabs: Schedule, coordinate, and install concrete slabs in a timely manner to allow concrete to cure sufficiently for moisture-sensitive floor finishes. Failure to do so, resulting in the requirement for moisture mitigation, will be Contractor's responsibility.
5. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
7. Punch List and Final Completion: Include not more than 30 days or the number of days indicated in the Agreement for punch list and Final Completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

2. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 45 days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Installation.
    g. Testing.
    h. Punch list and Final Completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.

4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
5. Float: Indicate float time for each activity.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.

F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

G. Causes for Extensions of Time:

1. The Contract completion date will be adjusted only for causes specified in the Contract. In the event the Contractor requests an extension of the Contract completion date, the Contractor shall furnish justification and supporting evidence as required by this Section and the General Conditions. The Owner will, after receipt of such justification and supporting evidence, make findings of fact and advise the Contractor in writing thereof. If the Owner determines that the Contractor is entitled to an extension of the Contract completion date, the Owner's determination of the time extension owed shall be based upon the approved CPM schedule or update. Actual delays in activities, which do not affect the scheduled Contract completion date, shall not serve as the basis for a change in Contract completion time.
2. The procedure for preparing and presenting delay justification is as follows:
    a. Create a schedule activity (or activities) that represent the scope of the change or delay.
    b. Assign durations and cost/manpower resources to these new activities.
    c. Determine appropriate logic ties for these new activities. Assign predecessors and successors so that these activities can tie into the existing schedule activities.
    d. These impact activities should be loaded into a separate copy of the updated schedule that immediately precedes the impact issue's time frame. For instance, if an impact issue occurs during mid-April, the new activities should be input into the March 31 (status date) update.
    e. Recalculate the Schedule with these impact activities in place.
3. The Impacted Schedule, along with the backup data describing the new schedule activities and logic ties which comprise the impact/delay issues, will be submitted to the Owner for review and

approval. If approved, these impact/delay issues will become a permanent part of the Project Schedule. The Contractor shall not unilaterally make changes to the Project Schedule to justify schedule impacts without the approval of the Owner.

4. Activity delays shall not automatically mean that an extension of the Contract Time is warranted or due the Contractor. Only those delays which impact the imposed Contract Completion Date or other CPM and contract milestone dates will be considered for time extensions.
5. Failure of the Contractor to furnish justification and supporting evidence for an extension of time, as detailed in this Section, within thirty (30) calendar days of the changed condition shall constitute a waiver of any claims for time extension associated with the issue.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completion authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Original target dates shall be retained in scheduling software for the duration of the Project.
2. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
3. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
4. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Predemolition photographs.
2. Periodic construction photographs.

1.2 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit unaltered, original, full-size image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.
b. Date photograph was taken.
c. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

PART 3 - EXECUTION

3.1 PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.

C. Preconstruction/Predemolition Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

1. Flag construction limits before taking construction photographs.
2. Provide a minimum of 15 photographs showing existing building conditions adjacent to or adjoining the construction area to accurately record physical conditions prior to starting the Work.

D. Additional Photographs: Architect may request photographs in addition to preconstruction photographs specified. Architect will determine number and frequency of photographs and general directions on vantage points.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

1.3 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
4. Format: Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

B. Closeout Submittal List: Submit a list of warranties, operation and maintenance manuals, and other closeout documents, arranged in Division/Section order as listed in the Project Manual.

1. Provide Table of Contents for Project Close Out document to the Architect for review, within 90 days of Notice to Proceed.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings may be available from Architect for Contractor's use in preparing submittals.

1. Upon request, Architect will furnish Contractor digital data drawing files of the Contract Drawings for use in preparing Shop Drawings, Coordination Drawings, and Project record drawings.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
b. Digital Drawing Software Program: The Contract Drawings are available in AutoCAD translated from Revit file.

2. The digital data files are available under the following conditions:

a. Contractor shall execute a data licensing agreement in the form of Digital Data Letter of Agreement.
b. Digital data drawings are not to be considered Contract Documents as defined by the General Conditions for the Contract for Construction.
c. The Contract Documents executed or identified in the Owner/Contractor Agreement, shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.
d. The Contractor shall not transfer or reuse Instruments of Service in electronic or machine-readable form without the prior written consent of the Architect.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittal Period: Provide all submittals to Architect and Architect's Consultants within 60 calendar days of the Notice to Proceed.

1. If submittals are not provided within the submittal period stated above, the Contractor shall provide one of the brands specified. No alternate manufacturers will be considered for review beyond the allowable submittal period. This does not relieve the Contractor from responsibility to provide all required shop drawings, product data, and samples.
2. If the number of submittals not received within the submittal period is significant or their nature deemed of specific importance, the Architect may recommend that the Owner suspend or delay payment to the Contractor until such time as the required submittals have been received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Architect will endeavor to perform initial review of submittal within 10 days. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Architect will endeavor to review resubmittals within 10 days.
3. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, reviewing parties will endeavor to review submittals within 10 days. Submittal will be returned to Architect before being returned to Contractor.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
    a. File name shall be Specification Section number followed by a hyphen and then a sequential number (e.g. 081113 - 01 HM Doors and Frames). Resubmittals shall include a digital suffix after another hyphen (e.g. 081113 - 01 - 01 HM Doors and Frames).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project information management system.
5. Metadata: Include the following information as keywords in the electronic file metadata:
    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.
    d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to Project Information Management System specifically established for Project.
    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Action Submittals: Submit electronic copies of each submittal unless otherwise indicated.
4. Informational Submittals: Submit electronic copies of each submittal unless otherwise indicated.
    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
    a. Manufacturer's catalog cuts, installation instructions, and product specifications.
    b. Color charts.
    c. Statement of compliance with specified referenced standards.
    d. Testing by recognized testing agency.
    e. Application of testing agency labels and seals.
    f. Notation of coordination requirements.
    g. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in PDF electronic file format.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or manufacturer's standard printed data or details. Submittals based on Architect's digital data drawing files are permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in PDF electronic file format.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of applicable Specification Section.
    e. Specification paragraph number and generic name of each item.
3. Provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit three sets of Samples.
        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in PDF electronic file format.

F. Subcontractor, Supplier and Manufacturer List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including major subcontractors, suppliers, and manufacturers.

G. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

H. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

I. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

J. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

K. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

L. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

M. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

N. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

O. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

P. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

Q. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

R. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

S. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. Professional Engineer Qualifications: Professional engineer performing delegated-design services shall be legally qualified to practice in jurisdiction where Project is located and shall be experienced in providing engineering services of the kind indicated.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, annotate to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

1. No Exceptions Taken: The work covered by the submittal may proceed.
2. Note Markings: The work covered by the submittal may proceed provided it complies with both the Architect’s notations and corrections on the submittal and the Contract Documents.
3. Rejected: Do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the contract document.

C. Informational Submittals: Architect will review each submittal and will return it, noting "No Action Taken." If it does not comply with requirements, Architect will return it noting "Revise and Resubmit." Architect will forward each submittal to appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review, with notation "Revise and Resubmit."

F. Submittals not required by the Contract Documents may be returned by the Architect without action, with notation "No Action Taken."

END OF SECTION 013300

DIGITAL DATA LETTER OF AGREEMENT

An Agreement Between the Architect and _____ (the "Transferee," either Original or Third Party, as the case may be) for Transfer of Digital Data

Architect: The Wilson Group
P.O. Box 5510
Charlotte, North Carolina 28299
Contact: Travis Pence

Transferee:
Original
3rd Party

Project No.: 7550-176990
Project Name: ILM Terminal Improvements Contract 2
Location: Wilmington, North Carolina
Date:

The Architect will provide the following Digital Data, dated as of the particular transmission, to the Transferee **for information purposes only (NOT FOR CONSTRUCTION, COST ESTIMATES, OR FABRICATION):**

1. AutoCAD Version 2010 translated from REVIT file:
   a) 1 Plan per level per discipline
   b) Individual sheets, partial plans, elevations sections and details will not be translated.

Digital Data was prepared using the following:

Software: AutoCAD (.dwg) **Version:**

Digital Data to be delivered via the following media: Newforma Website posting

Transferee shall pay the Architect a service fee of $____ and other good and valuable consideration.

TERMS AND CONDITIONS

1. The Architect and its consultants make no representation as to the compatibility of the Digital Data with any hardware or software. The Transferee shall notify the Architect within five (5) business days of any problems associated with accessing and/or using the Digital Data.

2. The Transferee acknowledges and agrees that the Digital Data may change or degrade during the transfer process. The Transferee acknowledges and agrees that the Architect and its consultants may remove all indications of ownership from the Digital Data prior to transmission.

3. All Digital Data shall be considered the property of the Architect and/or its consultants and shall not be used for other Projects, for additions to this Project, or for completion of this Project without the prior written permission of the Architect and/or its consultants. Digital Data shall not be re-transmitted by the Original Transferee to a Third Party Transferee without prior execution of an agreement identical to this Agreement between the Architect, the Original Transferee, and the Third Party Transferee. Under no circumstances shall the transmission of the Digital Data be considered a sale of goods or a sale of copyrights.

4. **THE ARCHITECT AND THE ARCHITECT'S CONSULTANTS HEREBY EXPRESSLY DISCLAIM ANY AND ALL WARRANTIES, BOTH EXPRESS AND IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY AND THE IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE AS WELL AS ANY WARRANTY OF ACCURACY, COMPLETENESS, AND/OR PERMANENCE. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE**

DESCRIPTION ON THE FACE HEREOF. Addenda information and/or revisions made to the most current Digital Data after any date of transmission may not have been incorporated into the transmitted Digital Data. In the event of a conflict between the Architect's printed instruments of service (whether sealed or not) and the Digital Data, the printed instruments of service shall govern. The Transferee acknowledges and agrees that the duty to determine the existence of any and all conflicts between the Digital Data and any other information upon which the Transferee relies rests solely upon the Transferee. The Digital Data shall not be considered Contract Documents or Construction Documents as defined by any General Conditions of Contract for Construction. The Digital Data is being provided on a strictly "AS IS" basis.

5. The use and/or provision of the Digital Data prepared by the Architect and/or its consultants shall not in any way reduce or obviate the Transferee's duty to check and coordinate dimensions, details, and quantities of materials as required to facilitate construction of the Project in a complete and quality manner consistent with the applicable standards of care. Confirmation of existing conditions is the sole responsibility of the Transferee.

6. The Transferee agrees to the extent permitted by applicable law, to indemnify, hold harmless, release, and defend the Architect and/or its consultants, their officers, shareholders, employees, and sub-consultants from any and all injuries, claims, demands, expenses, suits, liabilities, losses, damages, costs, disputes, other matters in question, third party claims, pass-through claims, subrogated claims, and/or claim expenses related to the Digital Data, including but not limited to, attorneys' fees, expert witness fees, and court costs arising out of or in any way related to or connected with any negligent act and/or omission in the generation, provision, and/or use of the Digital Data by the Transferee and/or any of its subcontractors, suppliers, and/or consultants and waive any and all rights to such claims and causes of action.

7. The Transferee waives damages against the Architect for any and all injuries, claims, losses, expenses, damages, disputes, other matters in question, and/or claim expenses arising out of or relating to this Agreement and/or generation, provision, and/or use of the Digital Data, including, but not limited to, consequential damages and reasonable attorneys' fees and defense costs.

8. The Architect's and/or the Architect's consultants' liability to the Transferee and/or any of its subcontractors, suppliers, and/or consultants for any and all injuries, claims, losses, expenses, damages, disputes, other matters in question, third party claims, pass-through claims, subrogated claims, and/or claim expenses arising out of or relating to this Agreement and/or the Digital Data, including, but not limited to, reasonable attorneys' fees and defense costs, regardless of the nature of the claim or damage, shall not exceed, either individually or in the aggregate, the total amount of $1,000.00. Such causes include, but are not limited to, the Architect's and/or the Architect's consultants' negligence, errors, omissions, strict liability, breach of contract, and/or breach of warranty.

9. To the best of the Architect's knowledge, information and belief, there are no licensing or copyright fees due to others based on the transmission of the Digital Data, but to the extent that such unknown fees do exist, the Transferee agrees to pay the required fees and hold the Architect and/or its consultants harmless from any associated costs or penalties.

10. Upon execution of this Agreement, the Architect grants to the Transferee a non-exclusive, non-transferable (except as set forth herein) license to use the Digital Data solely and exclusively for informational purposes only, provided that the Transferee substantially performs its obligations under this Agreement.

11. Any purchase order number provided by the Transferee is for the Transferee's accounting purposes only. The Transferee acknowledges and agrees that purchase order terms and conditions are null, void, and inapplicable to this Agreement.

12. This Agreement constitutes the entire agreement between the parties relative to the Digital Data and shall be governed by the laws of the State of North Carolina.

AUTHORIZED ACCEPTANCE

by Architect:
The Wilson Group

_____
Signature

_____
Print Name and Title

_____
Date

by Original Transferee:

_____

_____
Signature

_____
Print Name and Title

_____
Date

by Third Party Transferee:

_____

_____
Signature

_____
Print Name and Title

_____
Date

WE SO CONSENT:

by Owner:

_____

_____
Signature

_____
Print Name and Title

_____
Date

SECTION 013516 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes special procedures for alteration work.

1.3 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.4 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's

Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:
    a. Owner's continuing occupancy of portions of existing building.
    b. Owner's partial occupancy of completed Work.
    c. Other known work in progress.
    d. Tests and inspections.
3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns and adjacent to restricted areas. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Access to restricted areas may not be obstructed. Plan and execute the Work accordingly.

1. Refer to Construction Safety and Phasing Plan, Specifications and Civil Drawings for requirements. Comply with FAA requirements for active airfield.

1.5 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
    a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Fire-prevention plan.
    c. Governing regulations.
    d. Areas where existing construction is to remain and the required protection.
    e. Hauling routes.
    f. Sequence of alteration work operations.
    g. Storage, protection, and accounting for salvaged and specially fabricated items.
    h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
    i. Qualifications of personnel assigned to alteration work and assigned duties.
    j. Requirements for extent and quality of work, tolerances, and required clearances.
    k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.
3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.

a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:

1) Interface requirements of alteration work with other Project Work.
2) Status of submittals for alteration work.
3) Access to alteration work locations.
4) Effectiveness of fire-prevention plan.
5) Quality and work standards of alteration work.
6) Change Orders for alteration work.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.6 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed at Project site.

1.7 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule: Submit alteration work subschedule within 30 days of date established for commencement of alteration work.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

C. Alteration Work Program: Submit 30 days before work begins.

D. Fire-Prevention Plan: Submit 30 days before work begins.

1.8 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.

1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

a. Construct new mockups of required work whenever a supervisor is replaced.

B. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

C. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

D. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.9 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

1.10 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of measured drawings, preconstruction photographs, and preconstruction videotapes.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

F. Existing Roofing: Prior to the start of work in an area, install roofing protection.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated.
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

    a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:

    a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.

d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings. Comply with requirements in Section 013233 "Photographic Documentation."

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Composite Exterior Wall Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including Subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.

4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
d. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed unless otherwise indicated.

K. Composite Exterior Wall Mockups: Before ordering materials or commencing elements of the Work noted as part of the exterior wall mockup, build mockup for approval of exterior materials and finishes. Coordinate installation of exterior envelope materials and products in individual Specification Sections, along with supporting materials.

1. The mockup includes, but is not limited to, the following materials:

a. Masonry.
b. Masonry reinforcing.
c. Structural framing.
d. Metal panels.
e. Aluminum-framed entrances and storefront.
f. Aluminum windows.
g. Glazing.

h. Sealants.
i. Air barrier.
j. Insulation.
k. Flashing.

2. Schedule: Allow time for the construction of the mockup and review by Architect.
3. Submittal: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, finish and color designations, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

L. In-Place Mockups: Before installing portions of the Work requiring in-place mockups, construct mockups incorporating required materials, assemblies, and mechanical and electrical systems, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work.

1. Approved mockups may be incorporated into the Work.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014100 - SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division I Specification Sections, apply to this Section.

B. Refer to individual technical specification sections for specific qualifications, inspections, tests, frequency and standards required.

1.2 GENERAL REQUIREMENTS

A. Special Inspections shall be in accordance with Chapter 17 of the North Carolina State Building Code.

B. The program of Special Inspection is a system intended to ensure that the work is performed in accordance with the Contract Documents. These services do not relieve the Contractor and/or the Construction Manager of responsibility for compliance with the requirements of the Contract Documents.

C. This specification section is intended to inform the Contractor and/or the Construction Manager of the Owner's Special Inspection program and the extent of the responsibilities. This specification section is also intended to notify the Special Inspector, Testing Company/Testing Laboratory, and other Agents of the Special Inspector of their requirements and responsibilities.

D. Perform inspections in accordance with industry standard referenced for specific material or procedure unless other criteria are specified. In the absence of a referenced standard, perform inspections in accordance with generally accepted industry standards.

E. Failure to detect defective work or materials shall in no way prevent later rejection if defective work or materials are discovered.

1.3 SCHEDULE OF SPECIAL INSPECTIONS

A. Required Special Inspections are described in the Statement of Special Inspections on the Drawings.

1.4 DEFINITIONS

A. Testing: Evaluation of systems, primarily requiring physical manipulation and analysis of materials, in accordance with approved standards.

B. Inspection: Evaluation of systems, primarily requiring observation and judgment.

C. Special Inspection: Special Inspection herein includes items required by the current State Building Code, and other items which in the professional judgment of the Structural Engineer of Record, are critical to the integrity of the building structure.

D. Structural Engineer of Record (SER): The Licensed Engineer in responsible charge of the structural design for the project.

E. Testing Agency (TA):

1. Testing Agency: Approved independent materials testing agency acceptable to the Owner, Architect, and SER.

F. Special Inspector (SI): A licensed professional engineer responsible for administering and performing all Special Inspections required by the Statement of Special Inspections.

G. Agents of Special Inspection (AI): Individual inspectors performing specific Special Inspections on behalf of the Special Inspector.

H. Building Official: The Officer or duly authorized representative charged with the administration and enforcement of the State Building Code.

1.5 QUALIFICATIONS

A. The Special Inspector shall be a licensed Professional Engineer (licensed in state in which project is located) experienced with the type of work requiring Special Inspections, who is approved by the Owner, Structural Engineer of Record (SER) and Building Official.

B. Required inspector's qualifications for the Special Inspector and Agents of the Special Inspector are described in the attached Statement of Special Inspection.

1.6 SUBMITTALS

A. The Special Inspector shall submit to the Owner for review a copy of their qualifications which shall include the names and qualifications of each of the agents of Special Inspection who will be performing inspections.

1.7 PAYMENT

A. The Owner shall engage and pay for the services of the Special Inspector and Agents of the Special Inspector.

B. The Contractor and/or Construction Manager shall be responsible for the cost of any re-inspection of work which fails to comply with the requirements of the Contract Documents.

1.8 RESPONSIBILITIES/AUTHORITY

A. Special Inspection:

1. Special Inspector and Agents of Special Inspections:

a. Sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.
b. Inspect the work assigned for conformance with the contract documents and applicable material and workmanship provisions of the code. Perform inspection in a timely manner to avoid delay of work.
c. Bring nonconforming items to the immediate attention of the Contractor and/or Construction Manager for correction, then, if uncorrected after a reasonable period of time, to the attention of the Structural Engineer of Record, the Building Official, and to the Owner.
d. Submit inspection reports to the Contractor and/or Construction Manager, the Structural Engineer of Record, Owner, and other designated persons in accordance with the Statement of Special Inspection.

e. Submit a final signed report stating whether the work requiring Special Inspection was, to the best of the Special Inspector's knowledge, in conformance with the contract documents and the applicable workmanship provisions of the code.

2. Architect:

   a. Expedite resolution of construction issues.

3. Structural Engineer of Record:

   a. Identify items requiring Special Inspection and define qualifications of special inspector required for work.
   b. Prepare and sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.
   c. Review reports issued by Special Inspector.
   d. Assist in resolution of construction issues identified by Special Inspector.

4. Testing Agency:

   a. When engaged as a special inspector, provide Special Inspection services as noted in Item 1.8.A.1.
   b. Copy Special Inspector on all materials testing reports.

5. Contractor/Construction Manager:

   a. Arrange and attend all pre-construction meetings to review scope of Special Inspection. Include the Building Official, Owner, Architect, Structural Engineer of Record, Special Inspector, Testing Agency and other parties concerned.
   b. Post or make available the Statement of Special Inspection within the project site office. Provide timely notification to those parties designated on the schedule so they may properly prepare for and schedule their work.
   c. Provide special inspector access to the approved plans and specifications at the project site.
   d. Review all reports issued by special inspector.
   e. Retain at the project site all reports submitted by the special inspector for review by the building official upon request.
   f. Correct, in a timely manner, deficiencies identified in inspection reports.
   g. Provide safe access to the work requiring inspection.
   h. Provide labor and facilities to provide access to the work and to facilitate inspection.
   i. Sign the Contractor's Statement of Responsibility, if required, prior to commencing construction.

6. Fabricator/Supplier:

   a. Submit one copy of all material certificates and other quality assurance documents as required in the Statement of Special Inspections to the Special Inspector.

7. Building Official:

   a. Accept and sign completed Statement of Special Inspection.
   b. Review the final report submitted by special inspector.
   c. Determine work, which, in the Building Officials opinion, involves unusual hazards or conditions (IBC 1704.13 – Special Cases).

8. Owner:

   a. Provide and pay cost of Special Inspection services.
   b. Provide special inspector with Contract Documents and accepted shop drawings.
   c. Provide special inspector with full access to the site at all times.
   d. Sign the Statement of Special Inspection in conjunction with other responsible parties prior to commencing construction.

1.9 INSPECTION NOTES

A. Contractor and/or Construction Manager provide minimum of 24 hours notice for all items requiring inspection. Do not construct items requiring inspection services until testing and inspection services are available. Do not enclose or obscure items requiring inspection services until inspection services are performed.

1.10 LIMITS ON AUTHORITY

A. The Special Inspector may not release, revoke, alter, or increase the requirements of the Contract Documents.

B. The Special Inspector will not have control over the Contractor and/or Construction Manager means or methods of construction.

C. The Special Inspector shall not be responsible for construction site safety.

D. The Special Inspector has no authority to stop the work.

1.11 DAILY RECORDS AND REPORTS

A. Detailed daily reports shall be prepared by Special Inspector and Agents of Special Inspection of each inspection and submitted to the Special Inspector. Reports shall include, but not be limited to:

1. Date of inspection.
2. Name of inspector or agent.
3. Location of specific areas inspected.
4. Description of inspection and results.
5. Applicable ASTM standard.
6. Weather conditions.
7. Identification of product and specification section.

B. Any discrepancies from the Contract Documents found during a Special Inspection shall be immediately reported to the Contractor and/or Construction Manager. If the discrepancies are not corrected, the Special Inspector shall notify the Structural Engineer of Record and Owner. Reports shall document all discrepancies identified and the corrective action taken.

C. The Testing Company/Testing Laboratory shall immediately notify the Special Inspector of any test results which fail to comply with the requirements of the Contract Documents.

1.12 MONTHLY REPORTS

A. Monthly reports shall be prepared by the Special Inspector. Reports shall include, but not be limited to:

1. Summary of elements inspected during that month.
2. Copies of all discrepancies noted during that month.
3. Report of status of discrepancies including resolution of discrepancies.
4. Summary of all material certifications and quality assurance documents collected and reviewed during that month.

1.13 FINAL REPORT OF SPECIAL INSPECTIONS

A. The Final Report of Special Inspections shall be completed by the Special Inspector and submitted to the Structural Engineer of Record, Owner, Contractor and/or Construction Manager, and Building Official prior to the issuance of a Certificate of Use and Occupancy.

B. The Final Report of Special Inspections will certify that all required inspections have been performed and will itemize any discrepancies and how those discrepancies were resolved.

PART 2 - PRODUCTS (not applicable)

PART 3 - EXECUTION (not applicable)

END OF SECTION 014100

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. ICC - International Code Council; www.iccsafe.org.
2. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.2 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Water and Electric Power Service from Existing System: Water and electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.

3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL

A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.

B. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

E. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

F. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: Use of the permanent HVAC system for temporary use during construction is restricted by the condition listed below. If permanent HVAC system is used for temporary conditioning during construction, Contractor is responsible to protect return air from contamination by covering open end of duct with MERV 8 filter. Remove filter media at end of construction. Clean HVAC system as required in Section 017700 "Closeout Procedures."

a. Owner must authorize use of permanent HVAC system for temporary use during construction.

G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

2.2 TEMPORARY FACILITIES

A. Field Office: Contractor has option to provide a field office or use space in the existing building. Space is available in the existing bag room for a plan table.

1. Coordinate final location of field offices with Owner. Preferred site is adjacent to intersection of Airport Blvd and the loading dock access road, adjacent to west end of credit card lot.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 SITE USE PLAN

A. Confine operations within the areas indicated and as shown on the site use plan and as permitted by law, ordinances, and permits. Site shall not be unreasonably encumbered with materials, products, or construction equipment.

B. Contractor, in reviewing the use of the site, shall include access to proposed building for construction purposes, parking where possible for employees, temporary facilities including offices, storage, and workshop sheds or portable trailers, utility hookups, staging areas, storage materials and products, and unloading space.

C. Show additional area needed in the use of the site beyond that which may be indicated on the Drawings. Where additional fencing is required, such fencing shall be included at no additional cost to the Owner.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Storm Sewers and Storm Drainage: If storm sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If storm sewers are not available or cannot be used, provide storm drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither storm sewers nor storm drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Connect temporary storm sewers to municipal system as directed by authorities having jurisdiction.
2. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog storm sewers or pollute waterways before discharge.
3. Maintain temporary storm sewers and storm drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Final Acceptance, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets and wash facilities for use of construction personnel. Coordinate and comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Install self-contained toilet units. Use of Owner's existing toilets will not be permitted.
2. Disposable Supplies: Provide, and maintain adequate supply of, toilet tissue and similar disposable materials for use of construction personnel.
3. Contractors shall provide drinking water for use of their personnel.
4. Provide safety showers, eyewash fountains, and similar facilities where required by authorities having jurisdiction.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.

F. Ventilation and Humidity Control: Provide temporary ventilation and humidity control required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

H. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.

1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Electronic Communication Service: Provide wireless connectivity in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.

K. Telephone Numbers: Provide a list of important telephone numbers. Include the following:

1. Police and fire departments.
2. Ambulance service.
3. Contractor's home office.
4. Contractor's emergency after-hours telephone number.
5. Architect's office.
6. Engineers' offices.
7. Owner's office.
8. Principal subcontractors' field and home offices.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
3. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.

B. Traffic Controls: Coordinate and comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide temporary parking areas for construction personnel.

D. Dewatering Facilities and Drains: Coordinate and comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.

E. Project Signs: Provide Project sign as indicated. Unauthorized signs are not permitted.

1. Temporary Signs: Provide signs as required to inform public and individuals seeking entrance to Project. Provide temporary, directional signs for construction personnel and visitors.
2. Engage an experienced sign painter to apply graphics for Project identification signs.
3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood unless indicated otherwise, and in sizes and thicknesses indicated. Support on posts and framing of preservative-treated wood.
4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
5. Location of project identification sign as directed by Architect.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to normal business hours.

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Coordinate and comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

G. Pest Control: Perform control operations lawfully, using environmentally safe materials.

H. Barricades, Warning Signs, and Lights: Coordinate and comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

1. Provide protective measures as required to provide free and safe passage of the public on adjoining sidewalks and streets.

I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.

J. Temporary Partitions: Provide floor-to-ceiling dustproof non-combustible partitions to limit dust and dirt migration to completed areas. Protect air-handling equipment. Provide walk-off mats at each entrance through temporary partition.

K. Protect air-handling equipment.

L. Temporary Egress: Maintain temporary egress from existing occupied facilities as required by authorities having jurisdiction.

M. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.

1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
2. Paint and maintain appearance of walkway for duration of the Work.

N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.

1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
    a. Field Offices: Class A stored-pressure water-type extinguishers.
    b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
    c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
2. Prohibit smoking on Project site.
3. Supervise welding operations and similar sources of fire ignition according to requirements of authorities having jurisdiction.
4. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting.
5. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
6. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

8. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.6 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Control moisture and humidity inside building by maintaining effective dry-in conditions.

1. If authorized by Owner, use permanent HVAC system to control humidity.

C. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

1. Materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
2. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
3. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Projected delivery date or time span of delivery period.
    f. Identification of items that require early submittal approval for scheduled delivery date.

3. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
4. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Comparable Product Requests: Comply with requirements in Section 012500 "Substitution Procedures."

C. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.4 QUALITY ASSURANCE

A. Compatibility: Contractor is responsible for providing products and construction methods compatible with other products and construction methods used on the Project.

B. Asbestos: No asbestos or asbestos-containing material may be incorporated into the Work.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.

3. Refer to other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017836 "Warranties."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the conditions of Section 012500 "Substitution Procedures" are satisfied. If the conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit two copies signed by surveyor.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.

2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility, Architect, and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

C. Inform installers of lines and levels to which they must comply.

1. Check the location, level and plumb, of every major element as the Work progresses.
2. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
3. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

D. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

E. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

F. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Recycling nonhazardous demolition and construction waste.
2. Disposing of nonhazardous demolition and construction waste.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.3 PERFORMANCE REQUIREMENTS

A. Contractor is encouraged to recycle as much nonhazardous demolition and construction waste as practical, without incurring additional costs to the Owner.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 WASTE MANAGEMENT AND DISPOSAL

A. General: Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Review plan procedures and locations established for recycling and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    a. Inspect containers and bins for contamination and remove contaminated materials if found.
2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. Final cleaning.
4. Repair of the Work.

1.2 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.4 MAINTENANCE / EXTRA MATERIALS

A. Schedule of Maintenance / Extra Materials: For extra materials specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
2. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
3. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, stair surveys, property surveys, and similar final record information.
4. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
5. Submit extra materials specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.

a. Schedule of Extra Materials: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.

6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
7. Submit test/adjust/balance records.

B. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

C. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection, or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection to determine Final Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection, or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Submit list of incomplete items to Architect and Owner in the following format:

a. MS Excel electronic file. Architect will return annotated copy.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following formats:

1. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
2. PDF electronic file on DVD. Assemble each manual into a composite electronically indexed file.
    a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of operation and maintenance manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

1. Correct or revise each manual to comply with Architect's comments. Submit corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

D. Final Manual Submittal: Submit manuals in final form prior to requesting inspection for Substantial Completion.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.

2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR OPERATION AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain a title page, table of contents, and manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of Substantial Completion.
5. Project number.
6. Name and contact information for Contractor.
7. Name and contact information for Architect.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals:

1. Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

a. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf or post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

1) If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.

2) Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

b. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products included in the section on each divider, cross-referenced to Specification Section number.

c. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.

d. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

1) If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.

2) If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2. Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

a. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

b. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for type of emergency, emergency instructions and procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include instructions on stopping, shutdown instructions, operating instructions for conditions outside normal operating limits, required sequences for electric or electronic systems and special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT, SYSTEMS, AND EQUIPMENT MAINTENANCE MANUALS

A. Content: Include source information, product information, manufacturers' maintenance documentation, maintenance procedures, repair materials and sources, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds, as described below.

B. Source Information: List each product, system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Test and inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Troubleshooting guide.
5. Precautions against improper maintenance.
6. Schedule for routine cleaning and maintenance.
7. Disassembly; component removal, repair, and replacement; and reassembly instructions.
8. Aligning, adjusting, and checking instructions.
9. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials.

G. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.

H. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

I. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

J. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

END OF SECTION 017823

SECTION 017836 - WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

1.2 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.3 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

F. Warranty Commencement: Warranties required by the Contract Documents shall commence on the Date of Substantial Completion of the Work or designated portion thereof.

1.4 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. Prepare a written document utilizing the sample “General Warranty” form located at the end of this Section, ready for execution by the Contractor. The Contractor shall submit subcontractor, supplier, or manufacturer draft warranties to the Owner, through the Architect, for approval prior to final execution.

1. Refer to Divisions 2 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

D. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

E. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

1. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.
2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, name of the Contractor and date of Substantial Completion.
3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 017836

Attachment: Sample General Warranty

SAMPLE GENERAL WARRANTY

(To Be Printed on Company Letterhead. Letterhead Shall Include Phone and Fax Numbers)

GENERAL WARRANTY

Date:

Contractor: Name
Address
City, State, Zip Code

Owner: Name
Address
City, State Zip Code

Project: Name
Project Location: City, State

The above named contractor as the General Contractor for the Work on the above project, does hereby warrant that for a period of one (1) year from the date of the Date of Substantial Completion, the above Work that will remain free from all defects in workmanship and material, and that it will comply with all the specific requirements of the Contract Documents governing the Work.

_____
Signature

_____
Printed Name and Title

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Initial Submittal:

a. Submit full-size paper copy of marked-up record prints.
b. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

2. Final Submittal:

a. Submit one full-size and one half-size paper-copy set of marked-up record prints.
b. Include each drawing, whether or not changes and additional information were recorded.

3. Engineered Systems: For Manufacturer/Contractor engineered systems, i.e. fire protection systems, light gauge framing systems, panelized systems, etc., Contractor shall submit two sets of security protected record drawings as follows:

a. One in .DWG or acceptable CAD format (write protected);
b. One in .PDF format, with seals and signatures.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Record data as soon as possible after obtaining it.
c. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.

g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator and instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

A. At completion of training, submit complete training manual(s) for Owner's use.

1. Training Manual: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder.

B. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name of Architect.
c. Name of Contractor.
d. Date of video recording.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.

5. Adjustments: Include the following:

    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.

6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.

8. Repairs: Include the following:

    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

1. Electronic Media: DVD with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

a. Name of Contractor/Installer.
b. Business address.
c. Business phone number.
d. Point of contact.
e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

D. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 020050 - CIVIL PROJECT SPECIAL PROVISIONS

PSP-1 PROJECT CONSTRUCTION TRAFFIC SPEED LIMIT AND ADMINISTRATIVE FINES

Construction access for this project will use existing airport roadways. Construction traffic must share the road with normal airport traffic, including private passenger vehicles, rental cars, taxicabs, and commercial vehicles. The access routes include the airline passenger drop-off and pick up curb front area, multiple pedestrian crossings, taxi cab queueing areas, access to parking lots (passenger long term, passenger short term, rental car, general aviation, employee). The construction traffic speed limit for the terminal loop roadway, parking lot access roadways and loading dock access roadway shall be 15 MPH, regardless of any higher posted speed limits. All construction traffic, including but not limited to vehicles owned or operated by the general contractor, subcontractors, suppliers, freight carriers and all construction personnel shall strictly adhere to the 15 MPH construction traffic speed limit. In addition to applicable motor vehicle law enforcement, the Owner reserves the right to issue and the General Contractor shall be liable for an administrative fine of $200.00 per speed limit infraction by any vehicle involved in the construction. The Contractor shall include traffic and pedestrian safety considerations in all project meetings with subcontractors and suppliers.

PSP-2 TRAFFIC CONTROL

The Contractor shall be responsible for traffic control in all roadway and parking lot areas affected by the work. All traffic control materials and procedures shall be in general accordance with NCDOT standards and the MUTCD. The Contractor shall furnish a package of traffic control signs as per the table shown on the plans and as may otherwise be required by the Contractor's operations. The list of signs shall be the minimum; it shall be the Contractor's responsibility to provide additional signs as may be needed in support of particular operations. The Contractor shall prepare and submit a traffic control plan sketch for all short-term utility, storm drainage, grading, curb line, paving and other work operations which affect the roadside, roadway lanes and/or parking lot areas. The contractor shall provide temporary signage (as per the table and as otherwise needed), cones, drums, skinny drums, barricades, traffic plates, etc., in sufficient quantities as to safely guide vehicles and pedestrians around the work. The Contractor shall position and reposition signs, drums, cones, skinny drums, etc. as often as needed in support of the work. The Contractor shall provide flaggers as appropriate to the operation.

The terminal loop road, parking lot access roads and the loading dock access road shall be open to traffic at all times.

All costs for project traffic control shall be included in the project lump sum bid.

PSP-3 PROTECTION, RELOCATION AND RESTORATION OF UTILITIES AND SYSTEMS

It is the intent of this contract that the Contractor shall be responsible for including in the base bid and for coordinating and implementing all labor, materials and equipment, including the Contractor's forces and all subcontracted disciplines, for the identification, location, determination, protection, relocation and restoration of all utilities and systems serving the airline terminal complex. For the purposes of this provision, the term "utilities and systems" shall include the lines, equipment and service components owned and operated by public utilities (including but not limited to the Cape Fear Public Utilities Authority (CFPUA) (water, sewer), Duke Energy (electric), CenturyLink, Time Warner Cable/Spectrum, Piedmont Natural Gas); the lines and equipment associated with airport and tenant owned and operated electrical, water, sewer, storm drainage, HVAC, data and communications (copper and fiber optic); and airport and tenant owned integrated systems (including but not limited to security monitoring, access control, FIDS, flight status, public address, lighting control, fire alarm, HVAC). The lines and equipment shall include those in underground, under slab, overhead, surface mounted, roof mounted and building interior locations, including concealed spaces. The Contractor and subcontractors shall consider the extent of existing utilities and systems in the facility and the extent and nature of the demolition and construction operations necessary for the work, and shall carry all such temporary and permanent materials and work necessary by all disciplines to protect, relocate and restore utility and system components such that those utilities and components remain in service throughout the construction period and remain intact and operational upon project completion, except to the extent that new and/or replacement utilities, systems and/or subsystems are specified, completed and placed into service. Any relocations placed within the

existing main terminal building shall be coordinated in advance with the Architect so as to avoid/minimize conflicts with future Contract 3 construction. All costs for this work shall be included in the lump sum bid price for the project.

The Contractor shall include utility location services in the lump sum bid price for the project. For this purpose, the term "utility" shall be all inclusive, including but not limited to public and private utilities and service lines, water, sewer, gas, stormwater, electrical, communications, CATV, data, HVAC. The utility locating work shall include appropriate non-destructive techniques as well as test holes using vacuum extraction and/or other techniques. Test holes need not be executed in any given area until pavement removal operations are scheduled; however, critical crossings and alignments shall be confirmed by test hole sufficiently in advance (30 days) of proposed construction activities to allow for planning of grade and alignment adjustments. The Contractor shall obtain photographs, utility size measurements and positional measurements (horizontal and vertical) at all test holes and at all locations where utility elements are encountered in the course of the work. The utility locating work shall apply over the full limits of Part 1A construction. The Contractor shall submit utility location reports to the Architect for informational purposes within 14 days of the field work and shall immediately report data applicable to critical crossings and whenever the data indicates a potential or apparent conflict with any element of the work.

PSP-4 EXISTING UTILITY INFORMATION SHOWN ON PLANS

Existing public and private utilities, service lines and systems as shown on the civil plans are based on Quality Level B geophysical utility locating/designating services conducted for project design, field survey, visual observation of physical features, limited test holes and information depicted on old drawings. The information, including approximate locations and depths shown on profiles and sections may not be entirely complete nor entirely accurate. It is the intent of this contract that the Contractor will locate and verify all existing utilities, service lines and systems near work elements and crossings, shall protect and relocate affected lines and shall notify the Architect without delay regarding any apparent discrepancies or conflicts as they are identified.

PSP-5 AIR CARRIER APRON MARKINGS

This contract includes marking removal and application of temporary and permanent pavement markings on the air carrier aircraft parking apron. This work shall be performed in accordance with specification section 020 620 and shall include removal of existing markings and painting temporary markings as needed to implement the temporary staging area, baggage tug routes, etc. as shown on the Plans. The work also includes removal of the temporary markings upon construction completion. All costs shall be included in the lump sum bid price for the project.

PSP-6 ROADWAY, PEDESTRIAN AND PARKING LOT MARKINGS

This contract includes marking removal and application of temporary and permanent pavement markings for roadways, pedestrian crossings, parking lots, curb lines and related uses. All such markings shall be in accordance with NCDOT details and specifications and as detailed on the plans. All costs shall be included in the lump sum bid price for the project.

PSP-7 AIR CARRIER APRON CONSTRUCTION STAGING

A portion of the air carrier aircraft parking apron will be available to the Contractor for construction purposes. The apron features 14-inch nominal thickness concrete pavement constructed circa 1988 and is in good condition. The Contractor shall be responsible for conducting staging operations and those of all subcontractors in a manner which prevents damage to apron pavement and the joint sealant in all areas where the existing pavement is to remain in service following construction. Upon completion of construction operations, the contractor shall repair any staining, spalls, sealant damage, cracking, gouging or other damage to the satisfaction of the Architect and Owner. The Contractor is not granted general authorization to use core holes, drill holes or anchoring devices in the apron pavement for temporary purposes, except for cored holes for anchoring entrance portal gate posts. The Owner may consider but retains the right to refuse specific requests for temporary holes or anchorage. If so authorized, the Contractor shall patch all holes and remove and patch all anchorages using non-shrink grout to the full satisfaction of the Owner.

PSP-8 DUST AND FOD CONTROL

It is the intent of these specifications that the Contractor shall proactively control dust, grit, sand, gravel, debris, tools, hardware and loose material of any sort at all times during the course of the work. Active aircraft operations and airline ground support operations will be on-going on the apron adjacent to the work area. In addition to wind and rain, aircraft jet blast and propeller wash can lift and transport loose material, resulting in a significant FOD (foreign object damage) hazard, which can cause serious damage to aircraft, including engine damage and flight safety issues. The contractor shall maintain on site operational water truck, mechanical broom, vacuum sweeper and other equipment and shall utilize such equipment as frequently as necessary (including continuous operation) to prevent the occurrence of dust, grit or other hazard to aircraft safety or nuisance which is objectionable to the Airport, its tenants or the residents of the area or which violates existing laws or regulations.

The Contractor shall thoroughly clean and secure all work areas each day to the satisfaction of the Architect and Owner prior to releasing work crews.

PSP-9 CONSTRUCTION SITE DRAINAGE

The Contractor will be required to establish and maintain temporary diversions, low point sumps and other means to allow for draining or pumping of runoff from the construction area. Dewatering pump discharge shall be directed into sediment trapping bags. Stormwater runoff shall be removed from the construction site subgrade during and/or immediately following each rainfall event. All costs for maintaining construction site drainage shall be included in the project lump sum bid price.

PSP-10 DEBRIS DISPOSAL

The Contractor shall dispose of demolition debris off Airport property in a properly permitted facility. All costs for offsite disposal shall be included in the project lump sum bid. The Contractor is encouraged to recycle asphalt and concrete pavement materials.

PSP-11 MATERIAL MANIPULATION

The specifications require that soil materials be compacted within specific limits of optimum moisture. The wetting or drying of soil material, including any necessary manipulation to achieve the specified conditions, shall be included in the project lump sum price.

PSP-12 GROUND COVER REQUIREMENTS

In accordance with the North Carolina Sedimentation Control Rules (Title 15A, Chapter 4), a ground cover must be provided on all graded slopes within 14 working days following completion of any phase of grading and a permanent ground cover must be provided for all disturbed areas within 14 working days following completion of the final grading phase.

PSP-13 NIGHTTIME CONSTRUCTION OPERATIONS

Night time construction operations will be allowed on this project. The Contractor shall be responsible for providing adequate lighting for all work performed at night. Adequate lighting will be as determined by the Contractor and approved by the Architect and should be sufficient light to allow safe and continuous operation for all ongoing construction activities. Light provided should allow all equipment operators to see the work and to allow the Architect to provide adequate inspection. Construction lighting shall be positioned and oriented in a manner that does not result in light straying from the work area and impeding the visibility for air traffic controllers, airline ground personnel and pilots. Prior to any night time operations, the Contractor shall provide, at least 7 days in advance, a lighting layout plan to the Architect for review and coordination.

PSP-14 SALES TAX REPORTS

The Contractor shall submit a statement showing an invoice identification number, sales taxes paid to North Carolina, and sales taxes paid to county of vendor's location, for all material and equipment used in the project. A sales tax statement shall be submitted with each pay request and shall be accompanied by an affidavit verifying its accuracy.

PSP-15 CONSTRUCTION SAFETY AND PHASING PLAN

An Aviation Construction Safety and Phasing Plan (CSPP) document has been prepared for the project and is included as an Appendix to this project specification book. In accordance with FAA requirements, the Contractor shall review the document and prepare, submit and maintain (update) a Safety Plan Compliance Document (SPCD), providing supplemental data and formatted using the same Chapters as the CSPP.

PSP-16 FUEL AND ASPHALT CEMENT PRICE ADJUSTMENTS

Contract price adjustments ***WILL NOT*** be made based on fluctuations in fuel and/or asphalt cement prices.

PSP-17 CONTRACTOR CONTROL SURVEY

Horizontal and vertical control point data from the project design survey will be provided to the contractor. The contractor shall retain a North Carolina Licensed Land Surveyor to establish/verify horizontal and vertical control for the work. The contractor's surveyor shall perform field survey to verify the existing control points, shall reference available geodetic survey monuments in the project vicinity (including NGS SAC monuments on the airfield) and shall report any inconsistencies noted. The contractor's surveyor shall set no fewer than 10 additional horizontal and vertical control points around the perimeter of the project area and beyond the project disturbance limits. Refer to the plans for additional contractor survey requirements related to the existing building. Within 45 days following Notice to Proceed, the contractor shall submit a sealed survey plan and a narrative report describing the control survey verification, additional control set and contractor building survey.

PSP-18 SETTING UTILITY STRUCTURES TO FINAL GRADE

The Contractor shall set the tops of all utility structures (including but not limited to storm manholes, drainage inlets, sewer manholes, electrical hand holes, telecommunications handholes, cleanouts, valve boxes) to final finished grade, which may vary from top, rim or other surface grade indications shown on the plans. The Contractor shall review and verify grades prior to ordering structures and shall notify the architect of any discrepancies noted.

END OF CIVIL PROJECT SPECIAL PROVISIONS

SECTION 020100 - CIVIL CONSTRUCTION - NCDOT SPECIFICATIONS

PART 1 - GENERAL

100-1.1 Summary. Section Includes: Aggregate Base Course, Concrete Sidewalks and Curb Ramps, Concrete Curb & Gutter, Incidental Concrete Construction, Asphalt Pavement, Traffic Control, Pavement Markings (except markings on the aircraft parking apron), Traffic Signs, Erosion Control.

100-1.2 NCDOT Standard Specifications. Materials and work included in the section shall conform to the requirements of the North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures, January 2018 ("the Standard Specifications"), except as modified herein. Within the Standard Specifications, except as indicated by context, the term "Department" shall mean "Owner" and the term "Engineer" shall mean "Architect."

PART 2 - PRODUCTS

100-2.1 Concrete. Concrete for sidewalks, pedestrian areas and curb ramps (6" nominal thickness) and for raised median area, curb and gutter and cast-in-place drainage structure surface elements shall conform to the requirements for Class of Concrete AA per Table 1000-1 of the Standard Specifications. For these applications, concrete meeting the requirements of Section 020-501 may be used.

Concrete for other incidental applications shall conform to the requirements for Class of Concrete A or AA per Table 1000-1 of the Standard Specifications.
No Class B concrete shall be supplied for this project.

100-2.2 Alkali-Silica Reaction (ASR). All concrete supplied pursuant to the NCDOT Standard Specifications shall meet the ASR resistance measures outlined in subsection 1024-1 of the Standard Specifications.

100-2.3 Asphalt Pavement. Asphalt mixes shall conform to Section 610 of the Standard Specifications. Provide mixes as detailed on the plans. The final surface course mix may contain Reclaimed Asphalt Pavement (RAP) and/or Reclaimed Asphalt Shingles (RAS) in accordance with NCDOT Section 610 and an NCDOT approved mix design, except that RAP shall not exceed 25% and RAS shall not exceed 3% of the total mix by weight.

PART 3 - QUALITY CONTROL AND ASSURANCE

100-3.1 Aggregates, concrete and asphalt pavement materials shall be furnished in conformance with NCDOT QA/QC programs and supplier and Department data associated with those programs shall apply to the work under this contract. The Owner's independent testing laboratory will perform and report the following QA testing:

100-3.2 Aggregate Base Course. Field density testing and thickness checks, with a frequency of one test per 500 square yards.

100-3.3 Concrete. Sample fresh concrete, prepare a set of 5 compressive strength cylinders (lab cure and test at 7 and 28 days), perform slump, temperature and air tests. Sample at least one truck per day. Provide a minimum sampling frequency of one sample for every 500 cubic yards. Observe placements; record and verify batch tickets, placement within specified time frames (paragraph 1000-4 E of the Standard Specifications), consolidation (vibration), finishing, jointing and curing. Truck discharge shall be halted and the truck sent away once the elapsed time from batching has elapsed.

100-3.4 Asphalt Pavement. Field observation, thickness checks, field density (minimum one density test per 500 square yards, each lift).

PART 4 - MEASUREMENT AND PAYMENT

100-4.1 Work under the NCDOT Standard Specifications will not be measured for payment. The work shall be included in the project lump sum pricing.

END OF SECTION 020100

SECTION 020152 - EARTHWORK

DESCRIPTION

152-1.1 This item covers excavation, disposal, placement, and compaction of all soil materials within the limits of the work required to construct, support and backfill temporary work platforms, building foundations, floor slabs, utilities, storm drains, pavements and unpaved areas in accordance with these specifications and in conformity to the grades, dimensions, details and sections shown on the plans.

Requirements listed on the structural drawings in notes and details shall apply to all earthwork associated with the building foundations and slabs. In case of discrepancy, the contractor shall seek clarification from the structural engineer.

MATERIALS

152-2.1 Suitable Soils. Suitable soils for use to backfill foundations, utilities, storm drains and retaining walls and for use in pavement and floor slab subgrade preparation shall be clean granular materials with soil classifications of SP, SM or better, with not more than 15% passing the #200 sieve, free of stone or masonry fragments in excess of 2 inches in largest dimension and free of organics, clay balls and other unsuitable matter. The plasticity index shall not exceed 6.

152-2.2 Un-Suitable Soils. Un-Suitable soils shall include those with more than 15% passing the #200 sieve, containing stone or masonry fragments in excess of 2 inches in largest dimension, having a plasticity index greater than 6 or containing organics, clay balls, demolition debris or other unsuitable matter. Un-suitable soils shall include classifications GC, SC, CL, CH, MH OH, OL, PT.

152-2.3 On-Site Soils. The majority of excavated soil material on the project is expected to be suitable for re-use. Some pockets or lenses of poorer soil may be encountered. Soils containing excessive amounts of organic matter or demolition debris may be encountered. The Contractor shall stockpile suitable materials from project excavations separately from unsuitable and poor quality materials, reserving the higher quality soils for on-site use. The Contractor shall dispose of the excavated unsuitable soils off site. Surplus suitable soil may remain on-site for future use by others or may be disposed off site. If the Contractor elects to leave the surplus suitable soil on-site, it shall be neatly shaped, graded to drain, topsoiled and seeded to the satisfaction of the Architect and Owner.

152-2.4 Borrow. The Contractor shall provide suitable soil meeting the requirements of 152-2.1 from off-site borrow sources as required to establish building and pavement subgrades. In addition to soil classification and gradation test data, the Contractor shall furnish current CBR and Proctor test results for the proposed borrow source. The borrow material shall have a CBR no less than 15.

CONSTRUCTION METHODS

152-3.1 General. The suitability of material to be placed in embankments shall be subject to approval by the ENGINEER. All unsuitable material shall be disposed offsite. All stockpile areas shall be graded to allow positive drainage of the area and of adjacent areas. The surface elevation of stockpile areas shall not extend above the surface elevation of adjacent aircraft pavements on the airport, unless specified on the plans or approved by the ENGINEER.

When the Contractor’s excavating operations encounter artifacts of historical or archaeological significance, the operations shall be temporarily discontinued and the ENGINEER notified. At the direction of the ENGINEER, the Contractor shall excavate the site in such a manner as to preserve the artifacts encountered and allow for their removal. Such excavation will be paid for as extra work.

Those areas outside of the limits of the pavement areas where the top layer of soil material has become

compacted by hauling or other Contractor activities shall be scarified and disked to a depth of 4 inches, to loosen and pulverize the soil.

If it is necessary to interrupt existing surface drainage, sewers or under-drainage, conduits, utilities, or similar underground structures, the Contractor shall be responsible for and shall take all necessary precautions to preserve them or provide temporary services. The Contractor shall cut and plug or cap or remove abandoned items as indicated on the plans or as directed. The Contractor, at his or her expense, shall satisfactorily repair or pay the cost of all damage to such in-service facilities or structures that may result from any of the Contractor's operations during the period of the contract.

152-3.2 Excavation. No excavation shall be started until the work has been surveyed and staked out by the Contractor. All unpaved areas to be excavated shall be stripped of vegetation and topsoil. Topsoil shall be stockpiled for future use in areas designated on the plans. All suitable excavated material shall be used in the formation of embankment, subgrade, backfill or other purposes shown on the plans. All unsuitable material shall be disposed off site.

When the volume of the excavation exceeds that required to construct the embankments and backfill operations to the grades indicated, the excess shall be stockpiled on site or disposed off site at the option of the Contractor. When the volume of excavation is not sufficient for constructing the embankments to the grades indicated, the deficiency shall be obtained from borrow sources.

The grade shall be maintained so that the surface is well drained at all times. When necessary, temporary drains, drainage ditches and pumping systems shall be installed to intercept or divert surface water that may affect the work.

a. Selective Grading. Selective grading or borrow is required as stated in 152-2.3. The more suitable material encountered in the excavations shall be used in backfilling and subgrade preparation. If, at the time of excavation, it is not possible to place this material in its final location, it shall be stockpiled in approved areas.

b. Undercutting. Rock, shale, hardpan, loose rock, boulders, or other material unsatisfactory for foundations, subgrades, roads, shoulders, or any areas intended for turf shall be excavated to a minimum depth of 12 inches below the subgrade or to the depth specified by the ENGINEER. Muck, peat, matted roots, or other yielding material, unsatisfactory for subgrade foundation, shall be removed to the depth specified. Unsuitable materials shall be disposed off the airport. The excavated area shall be backfilled with suitable material obtained from the grading operations or borrow sources and compacted to specified densities.

c. Removal of Utilities and Structures. The removal of existing structures and utilities required to permit the orderly progress of work shall be accomplished by the Contractor unless otherwise shown on the plans. All existing foundations shall be excavated at least 2 feet below the top of subgrade or as indicated on the plans, and the material disposed off site. All foundations thus excavated shall be backfilled with suitable material and compacted as specified.

d. Compaction Requirements. The excavated subgrade under areas to be paved and under building footings and floor slabs shall be compacted to a depth of 12 inches and to a density of not less than 98 percent of the maximum density as determined by ASTM D698. The material to be compacted shall be within ±2% of optimum moisture content before being rolled to obtain the prescribed compaction.

The in-place field density shall be determined in accordance with ASTM D1556, ASTM D2167, or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. Stones or rock fragments larger than 3 inches in their greatest dimension will not be permitted in the top 6 inches of the subgrade.

Blasting shall not be allowed.

e. Proof Rolling. After compaction is completed, the pavement subgrade areas and prepared building pad areas shall be proof rolled with a 20 ton tandem axle dual wheel dump truck loaded to the legal limit with tires inflated to 80/100/150 psi or other equipment as authorized by the Engineer.

The proof roll shall be conducted in the presence of the ENGINEER. Apply a minimum of two coverages, or as specified by the ENGINEER, to all paved areas and building pad areas. A coverage is defined as the application of one tire print over the designated area. Soft areas of subgrade that deflect more than 1 inch or show permanent deformation greater than 1 inch shall be removed and replaced with suitable material or reworked to conform to the moisture content and compaction requirements in accordance with these specifications.

f. Construction Sequencing, Excavation Support and Dewatering. The Contractor shall be responsible for sequencing construction operations, providing excavation support (under pinning, shoring, sheeting, trench boxes, etc.), and dewatering (control of surface runoff, use of sump pumps, well pointing) so as to assure the stability of all excavations and to assure the stability of existing and new footings, utilities and other improvements located in close proximity to excavations.

152-3.3 Borrow Excavation. Borrow areas are not available within the airport property. When borrow sources are outside the boundaries of the airport property, it shall be the Contractor's responsibility to locate and obtain the borrow sources, subject to the approval of the ENGINEER. The Contractor shall notify the ENGINEER at least 15 days prior to beginning the excavation so necessary measurements and tests can be made. All borrow pits shall be opened up to expose the various strata of acceptable material to allow obtaining a uniform product. All unsuitable material shall be disposed of by the Contractor. Borrow pits shall be excavated to regular lines, and they shall be drained and left in a neat, presentable condition with all slopes dressed uniformly.

152-3.4 Footing Excavation. Excavations for building footings shall be made immediately ahead of forming and setting of reinforcing steel. Carefully excavate to the bottom of footing grade and avoid disturbing the subgrade soil. Run a plate compactor over the prepared footing subgrade. All footing subgrades are to be reviewed in the field by the project geotechnical consultant and approved by the project structural engineer. In the event that the foundation subgrade condition is found to be unsuitable, neatly overexcavate the footing area as directed and re-fill with compacted #57 or #67 stone. Protect prepared footing subgrades from damage due to stormwater runoff, construction activities or other causes, and proceed with foundation construction expeditiously following subgrade approval.

152-3.5 Preparation of Embankment (Fill) Area. Where an embankment is to be constructed to a height of 4 feet or less, all sod and vegetative matter shall be removed from the surface upon which the embankment is to be placed. The cleared surface shall be broken up by plowing or scarifying to a minimum depth of 6 inches and shall then be compacted as indicated in paragraph 152-3.6. When the height of fill is greater than 4 feet, sod not required to be removed shall be thoroughly disked and recompacted to the density of the surrounding ground before construction of embankment.

Sloped surfaces steeper than one (1) vertical to four (4) horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for the adjacent fill.

152-3.6 Formation of Embankments. Embankments (fills) shall be formed in successive horizontal layers of not more than 8 inches in loose depth for the full width of the cross-section, unless otherwise approved by the ENGINEER.

The layers shall be placed, to produce a soil structure as shown on the typical cross-section or as directed

by the ENGINEER. Materials such as brush, hedge, roots, stumps, grass and other organic matter, shall not be incorporated or buried in the embankment.

Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing, or other unsatisfactory weather conditions in the field. Frozen material shall not be placed in the embankment nor shall embankment be placed upon frozen material. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. The Contractor shall drag, blade, or slope the embankment to provide surface drainage at all times.

The material in each layer shall be within ±2% of optimum moisture content before rolling to obtain the prescribed compaction. To achieve a uniform moisture content throughout the layer, the material shall be moistened or aerated as necessary. Field density tests shall be taken for each 1,000 square yards of prepared area, for each lift. Based on these tests, the Contractor shall make the necessary corrections and adjustments in methods, materials or moisture content to achieve the specified embankment density.

Rolling operations shall be continued until each lift of the embankment or backfill is compacted to not less than 95% of maximum density as determined by ASTM D698. Under all areas to be paved, the top foot of the completed subgrade shall be compacted to a density of not less than 98 percent of the maximum density as determined by ASTM D698.

Fills under building foundations and slabs be placed in 10 inch maximum loose lifts when using large/heavy ride-on compactors, with each lift compacted to a density of not less than 95 percent of the maximum density as determined by ASTM D698. Loose lift thickness shall be reduced to 6 inches when using smaller/lighter Rammax type compactors and to 4 inches when using sled and jumping jack type compactors.

On all areas outside of the pavement areas, no compaction will be required on the top 4 inches.

The in-place field density shall be determined in accordance with ASTM D1556, ASTM D2167, or ASTM D6938 using Procedure A, the direct transmission method, and ASTM D6938 shall be used to determine the moisture content of the material. The machine shall be calibrated in accordance with ASTM D6938. The Contractor's laboratory shall perform all density tests in the ENGINEER's presence and provide the test results upon completion to the ENGINEER for acceptance.

Compaction areas shall be kept separate, and no layer shall be covered by another layer until the proper density is obtained.

Layer placement shall begin in the deepest portion of the embankment fill. As placement progresses, the layers shall be constructed approximately parallel to the finished pavement grade line.

152-3.7 Finishing and Protection of Subgrade. After the subgrade is substantially complete, the Contractor shall remove any soft or other unstable material over the full width of the subgrade that will not compact properly. All low areas, holes or depressions in the subgrade shall be brought to grade with suitable select material. Scarifying, blading, rolling and other methods shall be performed to provide a thoroughly compacted subgrade shaped to the lines and grades shown on the plans.

Grading of the subgrade shall be performed so that it will drain readily. The Contractor shall protect the subgrade from damage and limit hauling over the finished subgrade to only traffic essential for construction purposes. All ruts or rough places that develop in the completed subgrade shall be graded and recompacted.

No subbase, base, or surface course shall be placed on the subgrade until the subgrade has been approved by the ENGINEER.

152-3.8 Backfilling. Use care in placing and compacting backfill to avoid damage to pipes, utilities, structures

and building elements. Backfill around footings, behind retaining walls and around utility structures with suitable material placed in 8 inch maximum loose lifts. Compact to 95% of maximum density as determined by ASTM D698 (100% for the top foot of pavement and floor slab subgrade). Do not use heavy compaction equipment immediately adjacent to building footings and building and site retaining walls. Backfill and compact utility trenches with suitable material placed in 6 inch to 8 inch maximum loose lifts as detailed or specified on the plans or other specification sections.

152-3.9 Tolerances. In those areas upon which a subbase or base course is to be placed, the top of the subgrade shall be of such smoothness that, when tested with a 12-foot straightedge applied parallel and at right angles to the centerline, it shall not show any deviation in excess of 1/2 inch, or shall not be more than 0.05 feet from true grade as established by grade hubs. Any deviation in excess of these amounts shall be corrected by loosening, adding, or removing materials; reshaping; and recompacting.

On unpaved areas, the surface shall be of such smoothness that it will not vary more than 0.10 feet from true grade as established by grade hubs. Any deviation in excess of this amount shall be corrected by loosening, adding or removing materials, and reshaping.

152-3.10 Quality Assurance. The Owner's independent testing lab will perform and report the following testing. Collect and test at least four samples of suitable on site soil material (to represent the range of material variability encountered) and additional samples representing borrow sources; perform gradation, classification and standard Proctor testing. For off site borrow, provide CBR testing. Field testing: Observe proof rolls of prepared building pad areas and pavement subgrade areas. Perform field density testing at a frequency of one test per lift per 1000 feet for drainage and utility backfilling, one test per 500 square yards for pavement and slab subgrades, one test per 200 cubic yards of structural backfill. Perform field density checks, DCP tests and other evaluations as directed for all column footings; for all wall footings greater than 4 feet in width, at a rate of one test per 20 linear feet. For smaller wall footings, perform one density test and one DCP test per 50 linear feet of wall.

METHOD OF MEASUREMENT

152-4.1 Earthwork, including excavation, stockpiling, disposal, borrow, embankment, backfilling and subgrade preparation will not be measured for payment; all work shall be included in the project lump sum pricing.

TESTING REQUIREMENTS

ASTM D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
ASTM D2167	Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D6938	Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

END OF ITEM 020152

SECTION 020-162 - CHAIN-LINK FENCE

DESCRIPTION

162-1.1 This item shall consist of furnishing and erecting a chain-link fence in accordance with these specifications, the details shown on the plans, and in conformity with the lines and grades shown on the plans or established by the ENGINEER.

MATERIALS

162-2.0 General. All materials supplied under this contract are subject to the Buy American Act requirements.

Materials for temporary fencing and for restoration of permanent fencing shall be standard galvanized finish as noted below. Materials for the SARA fence shall be PVC/polymer coated galvanized steel, color to be selected by the Owner from manufacturer standard colors. Provide materials and colors in accordance with ASTM F668 (Class 2b), ASTM F934, ASTM F 1043, ASTM F1664 and ASTM F1665.

162-2.1 Fabric. The fabric shall be woven with a 9-gauge galvanized steel wire in a 2-inch mesh and shall meet the requirements of *ASTM A392, Class 2*.

Metallic-coated fabric shall have a clear acrylic coating applied to the selvage area after weaving.

162-2.2 Barbed Wire. Barbed wire shall be 2-strand 12-1/2 gauge zinc-coated wire with 4-point barbs and shall conform to the requirements of ASTM A121, Class 3, Chain Link Fence Grade.

162-2.3 Posts, Rails, and Braces. Line posts, rails, and braces shall conform to the requirements of ASTM F1043 or ASTM F1083 as follows:

Galvanized tubular steel pipe shall conform to the requirements of Group IA, (Schedule 40) coatings conforming to Type A, or Group IC (High Strength Pipe), External coating Type B, and internal coating Type B or D.

Roll Formed Steel Shapes (C-Sections) shall conform to the requirements of Group IIA, and be galvanized in accordance with the requirements of ASTM F1043, Type A.

Hot-Rolled Shapes (H Beams) shall meet the requirements of Group III, and be galvanized in accordance with the requirements of ASTM F1043, Type A.

The dimensions of the posts, rails, and braces shall be in accordance with Tables I through VI of Federal Specification RR-F-191/3.

162-2.4 Gates. Gate frames shall consist of galvanized steel pipe and shall conform to the specifications for the same material under paragraph 162-2.3. The fabric shall be of the same type material as used in the fence.

162-2.5 Wire Ties and Tension Wires. Wire ties for use in conjunction with a given type of fabric shall be of the same material and coating weight identified with the fabric type. Tension wire shall be 7-gauge marcelled steel wire with the same coating as the fabric type and shall conform to ASTM A824.

All material shall conform to Federal Specification RR-F-191/4.

162-2.6 Miscellaneous Fittings and Hardware. Miscellaneous steel fittings and hardware for use with zinc-coated steel fabric shall be of commercial grade steel or better quality, wrought or cast as appropriate to the article, and sufficient in strength to provide a balanced design when used in conjunction with fabric posts, and wires of the quality specified herein. All steel fittings and hardware shall be protected with a

zinc coating applied in conformance with ASTM A153. Barbed wire support arms shall withstand a load of 250 pounds applied vertically to the outermost end of the arm.

162-2.7 Concrete. Concrete shall be of a commercial grade with a minimum 28-day compressive strength of 3,000 psi.

162-2.8 Marking. Each roll of fabric shall carry a tag showing the kind of base metal (steel, aluminum, or aluminum alloy number), kind of coating, the gauge of the wire, the length of fencing in the roll, and the name of the manufacturer. Posts, wire, and other fittings shall be identified as to manufacturer, kind of base metal (steel, aluminum, or aluminum alloy number), and kind of coating.

CONSTRUCTION METHODS

162-3.1 Clearing Fence Line. All trees, brush, stumps, logs, and other debris which would interfere with the proper construction of the fence in the required location shall be removed a minimum width of 5 feet on each side of the fence centerline before starting fencing operations. The cost of removing and disposing of the material shall not constitute a pay item and shall be considered incidental to fence construction.

162-3.2 Installing Posts. All posts shall be set in concrete at the required dimension and depth and at the spacing shown on the plans.

Posts should be spaced not more than 10 feet apart and should be set a minimum of 36 inches in concrete footings. The posts holes shall be in proper alignment so that there is a minimum of 3 inches of concrete on all sides of the posts.

The concrete shall be thoroughly compacted around the posts by tamping or vibrating and shall have a smooth finish slightly higher than the ground and sloped to drain away from the posts. All posts shall be set plumb and to the required grade and alignment. No materials shall be installed on the posts, nor shall the posts be disturbed in any manner within seven (7) days after the individual post footing is completed.

Should rock be encountered at a depth less than the planned footing depth, a hole 2 inches larger than the greatest dimension of the posts shall be drilled to a depth of 12 inches. After the posts are set, the remainder of the drilled hole shall be filled with grout, composed of one part Portland cement and two parts mortar sand. Any remaining space above the rock shall be filled with concrete in the manner described above.

In lieu of drilling, the rock may be excavated to the required footing depth. No extra compensation shall be made for rock excavation.

162-3.3 Installing Top Rails. The top rail shall be continuous and shall pass through the post tops. The coupling used to join the top rail lengths shall allow for expansion.

162-3.4 Installing Braces. Horizontal brace rails, with diagonal truss rods and turnbuckles, shall be installed at all terminal posts.

162-3.5 Installing Fabric. The wire fabric shall be firmly attached to the posts and braced as shown on the plans. All wire shall be stretched taut and shall be installed to the required elevations. The fence shall generally follow the contour of the ground, with the bottom of the fence fabric no less than one inch or more than 4 inches from the ground surface. Grading shall be performed where necessary to provide a neat appearance.

At locations of small natural swales or drainage ditches and where it is not practical to have the fence conform to the general contour of the ground surface, longer posts may be used and multiple strands of barbed wire stretched to span the opening below the fence. The vertical clearance between strands of barbed wire shall be 6 inches or less.

162-3.6 Electrical Grounds. Electrical grounds shall be constructed at 500 feet intervals. The ground shall be accomplished with a copper clad rod 8 feet long and a minimum of 5/8 inches in diameter driven vertically until the top is 6 inches below the ground surface. A No. 6 solid copper conductor shall be clamped to the rod and to the fence in such a manner that each element of the fence is grounded. Installation of ground rods shall not constitute a pay item and shall be considered incidental to fence construction. The Contractor shall comply with FAA-STD-019, Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment, Paragraph 4.2.3.8, Lightning Protection for Fences and Gates, when fencing is adjacent to FAA facilities.

162-3.7 Cleaning Up. The Contractor shall remove from the vicinity of the completed work all tools, buildings, equipment, etc., used during construction. All disturbed areas shall be seeded.

METHOD OF MEASUREMENT

162-4.1 Chain-link fence will not be measured for payment; all work shall be included in the project lump sum pricing.

MATERIAL REQUIREMENTS

ASTM A121	Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A123	Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A392	Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A491	Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A572	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A653	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A824	Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM A1011	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High Strength Low Alloy with Improved Formability, and Ultra High Strength
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM B221	Standard Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Profiles and Tubes
ASTM B429	Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM F668	Standard Specification for Polyvinyl Chloride(PVC), Polyolefin and other Organic Polymer Coated Steel Chain-Link Fence Fabric

ASTM F1043	Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
ASTM F1083	Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures
ASTM F1183	Standard Specification for Aluminum Alloy Chain Link Fence Fabric
ASTM F1345	Standard Specification for Zinc 5% Aluminum-Mischmetal Alloy Coated Steel Chain-Link Fence Fabric
ASTM G152	Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G153	Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials
ASTM G155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials
FED SPEC RR-F-191/3	Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces)
FED SPEC RR-F-191/4	Fencing, Wire and Post, Metal (Chain-Link Fence Accessories)
FAA-STD-019	Lightning and Surge Protection, Grounding, Bonding and Shielding Requirements for Facilities and Electronic Equipment

END OF ITEM 020162

SECTION 020501 - PORTLAND CEMENT CONCRETE (PCC) PAVEMENT

DESCRIPTION

501-1.1 This work shall consist of pavement composed of Portland cement concrete (PCC), with and without reinforcement as detailed on the plans, constructed on a prepared underlying surface in accordance with these specifications and shall conform to the lines, grades, thickness, and typical cross-sections shown on the plans.

The pavement is not intended to support aircraft loads. It is intended to support airline ground support vehicles and equipment, maintenance vehicles and equipment and passenger vehicle traffic. It will be placed in small, irregular areas with numerous building structure and utility components which are expected to render use of heavy concrete paving equipment impractical.

This specification has been derived from FAA Item P-501 with the intent of providing durable, well consolidated concrete pavement.

MATERIALS

501-2.0 Alkali Silica Reaction (ASR) Mitigation.
The potential risk of ASR shall be mitigated by the use of low alkali cement and the use of Class F fly ash at no less than 25% by mass of the total cementitious content.

501-2.1 Aggregates.

a. Fine Aggregate. Fine aggregate shall conform to the requirements of ASTM C33. Grading of the fine aggregate, as delivered to the mixer, shall conform to the requirements of ASTM C33 and shall have a fineness modulus of not less than 2.50 nor more than 3.40. The soundness loss shall not exceed 10% when sodium sulfate is used or 15% when magnesium sulfate is used, after five cycles, when tested per ASTM C88.

The amount of deleterious material in the fine aggregate shall not exceed the following limits:

Limits for Deleterious Substances in Fine Aggregate for Concrete

Deleterious material	ASTM	Percentage by Mass
Clay Lumps and friable particles	ASTM C142	1.0
Material finer than 0.075mm (No. 200 sieve)	ASTM C117	3.0
Lightweight particles	ASTM C123 using a medium with a density of Sp. Gr. of 2.0	0.5
Total of all deleterious Material		3.0

b. Coarse Aggregate. Gradation, within the separated size groups, shall meet the coarse aggregate grading requirements of ASTM C33 when tested in accordance with ASTM C136. When the nominal maximum size of the aggregate is greater than one inch, the aggregates shall be furnished in two size groups.

Aggregates delivered to the mixer shall consist of crushed stone, crushed or uncrushed gravel,

crushed recycled concrete pavement, or a combination. The aggregate shall be composed of clean, hard, uncoated particles. Dust and other coating shall be removed from the aggregates by washing.

The percentage of wear shall be no more than 40% when tested in accordance with ASTM C131.

The quantity of flat, elongated, and flat and elongated particles in any size group coarser than 3/8 sieve shall not exceed 8% by weight when tested in accordance with ASTM D4791. A flat particle is defined as one having a ratio of width to thickness greater than 5. An elongated particle is one having a ratio of length to width greater than 5.

The soundness loss shall not exceed 12% when sodium sulfate is used or 18% when magnesium sulfate is used, after five cycles, when tested per ASTM C88.

The amount of deleterious material in the coarse aggregate shall not exceed the following limits:

Limits for Deleterious Substances in Coarse Aggregate for Concrete		
Deleterious material	ASTM	Percentage by Mass
Clay Lumps and friable particles	ASTM C142	1.0
Material finer than No. 200 sieve (0.075mm)	ASTM C117	1.0
Lightweight particles	ASTM C123 using a medium with a density of Sp. Gr. of 2.0	0.5
Chert (less than 2.40 Sp Gr.)	ASTM C123 using a medium with a density of Sp. Gr. of 2.40)	1.0
Total of all deleterious Material		3.0

Table 1. Gradation For Coarse Aggregate
(ASTM C33)

Sieve Designations (square openings)	Percentage by Weight Passing Sieves (No. 57 Aggregate)
inch	
2-1/2	---
2	---
1-1/2	*100*
1	*95-100*
3/4	---
1/2	*25-60*
3/8	---
No. 4	*0-10*
No. 8	*0-5*

(1) Aggregate Susceptibility to Durability (D) Cracking. Aggregates that have a history of D-cracking shall not be used.

Coarse aggregate may be accepted from sources that have a 20 year service history for the same gradation to be supplied with no durability issues. Aggregates that do not have a record of 20 years of service without major repairs (less than 5% of slabs replaced) in similar conditions without D-cracking shall not be used unless it meets the following:

(a) Material currently being produced shall have a durability factor ≥ 95 using ASTM C666 procedure B. Coarse aggregates that are crushed granite, calcite cemented sandstone, quartzite, basalt, diabase, rhyolite or trap rock are considered to meet the D-cracking test but must meet all other quality tests. Aggregates meeting State Highway Department material specifications may be acceptable.

(b) The Contractor shall submit a current certification that the aggregate does not have a history of D-cracking and that the aggregate meets the state specifications for use in PCC pavement for use on interstate highways. Certifications, tests and any history reports must be for the same gradation as being proposed for use on the project. Certifications which are not dated or which are over one (1) year old or which are for different gradations will not be accepted. Test results will only be accepted when tests were performed by a State Department of Transportation (DOT) materials laboratory or an accredited laboratory.

501-2.2 Cement. Cement shall conform to the requirements of ASTM C150 Type I or II. Low alkali cement (less than 0.6% equivalent alkalies) shall be supplied.

Total Alkalies (Na2O and K2O) of the cement secured for the production of concrete shall be independently verified in accordance with ASTM C114.

If cement becomes partially set or contains lumps of caked cement, it shall be rejected. Cement salvaged from discarded or used bags shall not be used.

501-2.3 Cementitious Materials.

a. Fly Ash. Fly ash shall meet the requirements of ASTM C618, Class F, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash for use in mitigating alkali-silica reactivity shall have a Calcium Oxide (CaO) content of less than 13% and a total available alkali content less than 3% per ASTM C311. Fly ash produced in furnace operations using liming materials or soda ash (sodium carbonate) as an additive shall not be acceptable. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the mix design, and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the ENGINEER.

501-2.4 Joint Seal. The joint seal for the joints in the concrete pavement shall meet the requirements of Item 020-605 and shall be of the type specified in the plans.

501-2.5 Isolation Joint Filler. Premolded joint filler for isolation joints shall conform to the requirements of ASTM D1751 or ASTM D1752, Type II or III and shall be where shown on the plans. The filler for each joint shall be furnished in a single piece for the full depth and width required for the joint, unless otherwise specified by the ENGINEER. When the use of more than one piece is required for a joint, the abutting ends shall be fastened securely and held accurately to shape by stapling or other positive fastening means satisfactory to the ENGINEER.

501-2.6 Steel Reinforcement. Reinforcing shall conform to the following:

ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

Welded wire fabric shall be furnished in flat sheets only.

501-2.7 Dowel and Tie Bars. Dowel bars shall be plain steel bars conforming to ASTM A615 and shall be free from burring or other deformation restricting slippage in the concrete. Before delivery to the construction site each dowel bar shall be epoxy coated per ASTM A1078. The dowels shall be coated with a bond-breaker recommended by the manufacturer. Dowel sleeves or inserts are not permitted. Grout retention rings shall be fully circular metal or plastic devices capable of supporting the dowel until the grout hardens.

Tie bars shall be deformed steel bars and conform to the requirements of ASTM A615. Tie bars designated as Grade 60 in ASTM A615 or ASTM A706 shall be used for construction requiring bent bars.

501-2.8 Water. Water used in mixing or curing shall be potable, clean, free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product, except that non-potable water, or water from concrete production operations, may be used if it meets the requirements of ASTM C1602.

501-2.9 Material for Curing Concrete. Curing materials shall conform to one of the following specifications:

a. Liquid membrane-forming compounds for curing concrete shall conform to the requirements of ASTM C309, Type 2, Class B, or Class A if wax base only.

b. White polyethylene film for curing concrete shall conform to the requirements of ASTM C171.

c. White burlap-polyethylene sheeting for curing concrete shall conform to the requirements of ASTM C171.

d. Waterproof paper for curing concrete shall conform to the requirements of ASTM C171.

501-2.10 Admixtures. The Contractor shall submit certificates indicating that the material to be furnished meets all of the requirements indicated below. In addition, the ENGINEER may require the Contractor to submit complete test data from an approved laboratory showing that the material to be furnished meets all of the requirements of the cited specifications. Subsequent tests may be made of samples taken by the ENGINEER from the supply of the material being furnished or proposed for use on the work to determine whether the admixture is uniform in quality with that approved.

a. Air-Entraining Admixtures. Air-entraining admixtures shall meet the requirements of ASTM C260 and shall consistently entrain the air content in the specified ranges under field conditions. The air-entrainment agent and any water reducer admixture shall be compatible.

b. Water-Reducing Admixtures. Water-reducing admixture shall meet the requirements of ASTM C494, Type A, B, or D. ASTM C494, Type F and G high range water reducing admixtures and ASTM C1017 flowable admixtures shall not be used.

c. Other Admixtures. The use of set retarding, and set-accelerating admixtures shall be approved by

the ENGINEER. Retarding shall meet the requirements of ASTM C494, Type A, B, or D and set-accelerating shall meet the requirements of ASTM C494, Type C. Calcium chloride and admixtures containing calcium chloride shall not be used.

501-2.11 Epoxy-Resin. All epoxy-resin materials shall be two-component materials conforming to the requirements of ASTM C881, Class as appropriate for each application temperature to be encountered, except that in addition, the materials shall meet the following requirements:

a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.

b. Material for use as patching materials for complete filling of spalls and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.

c. Material for use for injecting cracks shall be Type IV, Grade 1.

d. Material for bonding freshly mixed Portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete shall be Type V, Grade as approved.

501-2.12 Material Acceptance. Prior to use of materials, the Contractor shall submit certified test reports to the ENGINEER for those materials proposed for use during construction. The certification shall show the appropriate ASTM test for each material, the test results, and a statement that the material passed or failed.

The ENGINEER may request samples for testing, prior to and during production, to verify the quality of the materials and to ensure conformance with the applicable specifications.

MIX DESIGN

501-3.1 General. No concrete shall be placed until the mix design has been submitted to the ENGINEER for review and the ENGINEER has taken appropriate action. The ENGINEER's review shall not relieve the Contractor of the responsibility to select and proportion the materials to comply with this section.

501-3.2 Proportions. Concrete shall be proportioned to achieve a 28-day compressive strength that meets or exceeds the acceptance criteria contained in paragraph 501-5.2 for a compressive strength of 4,500 psi per ASTM C39. The mix shall be developed using the procedures contained in the Portland Cement Association's (PCA) publication, "Design and Control of Concrete Mixtures".

The minimum cementitious material shall be adequate to ensure a workable, durable mix. The minimum cementitious material (cement plus fly ash, or slag cement) shall be 470 pounds per cubic yard. The ratio of water to cementitious material, including free surface moisture on the aggregates but not including moisture absorbed by the aggregates shall not be more than 0.45 by weight.

Compressive strength test specimens (6" diameter x 12" long) shall be prepared in accordance with ASTM C192 and tested in accordance with ASTM C39. The mix determined shall be workable concrete having a maximum allowable slump between one and three inches as determined by ASTM C143.

Before the start of paving operations and after approval of all material to be used in the concrete, the Contractor shall submit a mix design showing the proportions and compressive strength obtained from the concrete at seven (7) and 28 days. The mix design shall include copies of test reports, including test dates, and a complete list of materials including type, brand, source, and amount of cement, fly ash, ground slag, coarse aggregate, fine aggregate, water, and admixtures. The mix design shall be submitted to the ENGINEER at least 30 days prior to the start of operations. The submitted mix design shall not be more than 90 days old. Production shall not begin until the mix design is approved in writing by the ENGINEER.

If a change in sources is made, or admixtures added or deleted from the mix, a new mix design must be submitted to the ENGINEER for approval.

The results of the mix design shall include a statement giving the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one cubic yard basis. Aggregate quantities shall be based on the mass in a saturated surface dry condition. The recommended mixture proportions shall be accompanied by test results demonstrating that the proportions selected will produce concrete of the qualities indicated. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in PCA's publication, Design and Control of Concrete Mixtures.

The submitted mix design shall be stamped or sealed by the responsible professional ENGINEER of the laboratory and shall include the following items as a minimum:

a. Coarse, fine, and combined aggregate gradations and plots including fineness modulus of the fine aggregate.
b. Deleted.
c. Coarse aggregate quality test results, including deleterious materials.
d. Fine aggregate quality test results, including deleterious materials.
e. Mill certificates for cement and supplemental cementitious materials.
f. Certified test results for all admixtures, including Lithium Nitrate if applicable.
g. Specified compressive strength, slump, and air content.
h. Recommended proportions/volumes for proposed mixture and trial water-cementitious materials ratio, including actual slump and air content.
i. Compressive strength summaries and plots, including all individual cylinder breaks.
j. Correlation ratios for acceptance testing and Contractor Quality Control testing, when applicable.
k. Historical record of test results documenting production standard deviation, when applicable.

501-3.3 Cementitious Materials.

a. Fly Ash. Fly ash shall be used as a partial replacement for cement. The replacement rate shall be determined from laboratory trial mixes, and shall be between 25 and 30% by weight of the total cementitious material.

501-3.4 Admixtures.

a. Air-Entraining Admixtures. Air-entraining admixture are to be added in such a manner that will ensure uniform distribution of the agent throughout the batch. The air content of freshly mixed air-entrained concrete shall be based upon trial mixes with the materials to be used in the work adjusted to produce concrete of the required plasticity and workability. The percentage of air in the mix shall be 4.5%. Air content shall be determined by testing in accordance with ASTM C231 for gravel and stone coarse aggregate and ASTM C173 for slag and other highly porous coarse aggregate.

b. Water-Reducing Admixtures. Water-reducing admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted on trial mixes, with the materials to be used in the work, in accordance with ASTM C494.

c. Other Admixtures. Set controlling, and other approved admixtures shall be added to the mix in the manner recommended by the manufacturer and in the amount necessary to comply with the specification requirements. Tests shall be conducted on trial mixes, with the materials to be used in the work, in accordance with ASTM C 494.

CONSTRUCTION METHODS

501-4.1 Equipment. Equipment necessary for handling materials and performing all parts of the work shall be approved by the ENGINEER, but does not relieve the Contractor of the responsibility for the proper operation of equipment and maintaining the equipment in good working condition. The equipment shall be at the jobsite sufficiently ahead of the start of paving operations to be examined thoroughly and approved.

a. Batch Plant and Equipment. The batch plant and equipment shall conform to the requirements of ASTM C94.

b. Mixers and Transportation Equipment.

(1) General. Concrete may be mixed at a central plant, or wholly or in part in truck mixers. Each mixer shall have attached in a prominent place a manufacturer's nameplate showing the capacity of the drum in terms of volume of mixed concrete and the speed of rotation of the mixing drum or blades.

(2) Central Plant Mixer. Central plant mixers shall conform to the requirements of ASTM C94. The mixer shall be examined daily for changes in condition due to accumulation of hard concrete or mortar or wear of blades. The pickup and throwover blades shall be replaced when they have worn down 3/4 inch or more. The Contractor shall have a copy of the manufacturer's design on hand showing dimensions and arrangement of blades in reference to original height and depth.

(3) Truck Mixers and Truck Agitators. Truck mixers used for mixing and hauling concrete and truck agitators used for hauling central-mixed concrete shall conform to the requirements of ASTM C94.

(4) Nonagitator Trucks. Nonagitating hauling equipment shall conform to the requirements of ASTM C94.

c. Finishing Equipment.
Concrete pavement shall be placed with approved placement and finishing equipment using stationary side forms. Hand screeding and float finishing may only be used on small irregular areas as allowed by the ENGINEER.

d. Vibrators. Vibrator shall be the internal type. Operating frequency for internal vibrators shall be between 8,000 and 12,000 vibrations per minute. Average amplitude for internal vibrators shall be 0.025-0.05 inch.

The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of American Concrete Institute (ACI) 309, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The Contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the ENGINEER.

Hand held vibrators may be used in areas where use of paver or span bridge mounted internal vibrators is impractical, and shall meet the recommendations of ACI 309R, Guide for Consolidation of Concrete.

e. Concrete Saws. The Contractor shall provide sawing equipment adequate in number of units and power to complete the sawing to the required dimensions. The Contractor shall provide at least one standby saw in good working order and a supply of saw blades at the site of the work at all times

during sawing operations. Early-entry saws may be used, subject to demonstration and approval of the ENGINEER.

f. Side Forms. Straight side forms shall be made of steel and shall be furnished in sections not less than 10 feet in length. Forms shall have a depth equal to the pavement thickness at the edge, and a base width equal to or greater than the depth. Flexible or curved forms of proper radius shall be used for curves of 100-foot radius or less. Forms shall be provided with adequate devices for secure settings so that when in place they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms with battered top surfaces and bent, twisted or broken forms shall not be used. Built-up forms shall not be used, except as approved by the ENGINEER. The top face of the form shall not vary from a true plane more than 1/8 inch in 10 feet, and the upstanding leg shall not vary more than 1/4 inch. The forms shall contain provisions for locking the ends of abutting sections together tightly for secure setting. Wood forms may be used under special conditions and for pavements less than 10 inches thick, when approved by the ENGINEER.

501-4.2 Form Setting. Forms shall be set sufficiently in advance of the concrete placement to ensure continuous paving operation. After the forms have been set to correct grade, the underlying surface shall be thoroughly tamped, either mechanically or by hand, at both the inside and outside edges of the base of the forms. Forms shall be staked into place sufficiently to maintain the form in position for the method of placement.

Form sections shall be tightly locked and shall be free from play or movement in any direction. The forms shall not deviate from true line by more than 1/8 inch at any joint. Forms shall be so set that they will withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment. Forms shall be cleaned and oiled prior to the placing of concrete.

The alignment and grade elevations of the forms shall be checked and corrections made by the Contractor immediately before placing the concrete.

501-4.3 Deleted.

501-4.4 Conditioning of Underlying Surface. The prepared underlying surface shall be moistened with water, without saturating, immediately ahead of concrete placement to prevent rapid loss of moisture from the concrete. Damage caused by hauling or usage of other equipment shall be corrected and retested at the option of the ENGINEER. If damage occurs to a stabilized subbase, it shall be corrected full depth by the Contractor. A template shall be provided and operated on the forms immediately in advance of the placing of all concrete. The template shall be propelled only by hand and not attached to a tractor or other power unit. Templates shall be adjustable so that they may be set and maintained at the correct contour of the underlying surface. The adjustment and operation of the templates shall be such as will provide an accurate retest of the grade before placing the concrete thereon. All excess material shall be removed and wasted. Low areas shall be filled and compacted to a condition similar to that of the surrounding grade. The underlying surface shall be protected so that it will be entirely free from frost when the concrete is placed. The use of chemicals to eliminate frost in the underlying surface shall not be permitted.

The template shall be maintained in accurate adjustment, at all times by the Contractor, and shall be checked daily.

501-4.5 Handling, Measuring, and Batching Material. The batch plant site, layout, equipment, and provisions for transporting material shall assure a continuous supply of material to the work. Stockpiles shall be constructed in such a manner that prevents segregation and intermixing of deleterious materials. Aggregates from different sources shall be stockpiled, weighed and batched separately at the concrete batch plant.

Aggregates that have become segregated or mixed with earth or foreign material shall not be used. All aggregates produced or handled by hydraulic methods, and washed aggregates, shall be stockpiled or binned for draining at least 12 hours before being batched. Rail shipments requiring more than 12 hours will be accepted as adequate binning only if the car bodies permit free drainage.

Batching plants shall be equipped to proportion aggregates and bulk cement, by weight, automatically using interlocked proportioning devices of an approved type. When bulk cement is used, the Contractor shall use a suitable method of handling the cement from weighing hopper to transporting container or into the batch itself for transportation to the mixer, such as a chute, boot, or other approved device, to prevent loss of cement. The device shall be arranged to provide positive assurance that the cement content specified is present in each batch.

501-4.6 Mixing Concrete. The concrete may be mixed at the work site, in a central mix plant or in truck mixers. The mixer shall be of an approved type and capacity. Mixing time shall be measured from the time all materials, except water, are emptied into the drum. All concrete shall be mixed and delivered to the site in accordance with the requirements of ASTM C94.

Mixed concrete from the central mixing plant shall be transported in truck mixers, truck agitators, or non-agitating trucks. The elapsed time from the addition of cementitious material to the mix until the concrete is deposited in place at the work site shall not exceed 30 minutes when the concrete is hauled in non-agitating trucks, nor 90 minutes when the concrete is hauled in truck mixers or truck agitators. Retempering concrete by adding water or by other means will not be permitted. With transit mixers additional water may be added to the batch materials and additional mixing performed to increase the slump to meet the specified requirements provided the addition of water is performed within 45 minutes after the initial mixing operations and provided the water/cementitious ratio specified in the approved mix design is not exceeded, and approved by the ENGINEER.

501-4.7 Limitations on Mixing and Placing. No concrete shall be mixed, placed, or finished when the natural light is insufficient, unless an adequate and approved artificial lighting system is operated.

a. Cold Weather. Unless authorized in writing by the ENGINEER, mixing and concreting operations shall be discontinued when a descending air temperature in the shade and away from artificial heat reaches 40°F and shall not be resumed until an ascending air temperature in the shade and away from artificial heat reaches 35°F.

   The aggregate shall be free of ice, snow, and frozen lumps before entering the mixer. The temperature of the mixed concrete shall not be less than 50°F at the time of placement. Concrete shall not be placed on frozen material nor shall frozen aggregates be used in the concrete.

   When concreting is authorized during cold weather, water and/or the aggregates may be heated to not more than 150°F. The apparatus used shall heat the mass uniformly and shall be arranged to preclude the possible occurrence of overheated areas which might be detrimental to the materials.

b. Hot Weather. During periods of hot weather when the maximum daily air temperature exceeds 85°F, the following precautions shall be taken.

   The forms and/or the underlying surface shall be sprinkled with water immediately before placing the concrete. The concrete shall be placed at the coolest temperature practicable, and in no case shall the temperature of the concrete when placed exceed 90°F. The aggregates and/or mixing water shall be cooled as necessary to maintain the concrete temperature at or not more than the specified maximum.

   The finished surfaces of the newly laid pavement shall be kept damp by applying a water-fog or mist with approved spraying equipment until the pavement is covered by the curing medium. When necessary, wind screens shall be provided to protect the concrete from an evaporation rate in excess

of 0.2 psf per hour. When conditions are such that problems with plastic cracking can be expected, and particularly if any plastic cracking begins to occur, the Contractor shall immediately take such additional measures as necessary to protect the concrete surface. Such measures shall consist of wind screens, more effective fog sprays, and similar measures commencing immediately behind the paver. If these measures are not effective in preventing plastic cracking, paving operations shall be immediately stopped.

c. Temperature Management Program. Prior to the start of paving operation for each day of paving, the Contractor shall provide the ENGINEER with a Temperature Management Program for the concrete to be placed to assure that uncontrolled cracking is avoided. As a minimum the program shall address the following items:

(1) Anticipated tensile strains in the fresh concrete as related to heating and cooling of the concrete material.

(2) Anticipated weather conditions such as ambient temperatures, wind velocity, and relative humidity; and anticipated evaporation rate using Figure 11-8, PCA, Design and Control of Concrete Mixtures.

(3) Anticipated timing of initial sawing of joint.

(4) Anticipated number and type of saws to be used.

501-4.8 Placing Concrete. At any point in concrete conveyance, the free vertical drop of the concrete from one point to another or to the underlying surface shall not exceed 3 feet. The finished concrete product must be dense and homogeneous, without segregation and conforming to the standards in this specification. Backhoes and grading equipment shall not be used to distribute the concrete in front of the paver. Front end loaders will not be used. All concrete shall be consolidated without voids or segregation, including under and around all load-transfer devices, joint assembly units, and other features embedded in the pavement. Hauling equipment or other mechanical equipment can be permitted on adjoining previously constructed pavement when the concrete strength reaches a compressive strength of 3,500 psi, based on the average of four field cured specimens per 2,000 cubic yards of concrete placed. Also, subgrade and subbase planers, concrete pavers, and concrete finishing equipment may be permitted to ride upon the edges of previously constructed pavement when the concrete has attained a minimum compressive strength of 2,500 psi.

The Contractor shall have available materials for the protection of the concrete during inclement weather. Such protective materials shall consist of rolled polyethylene sheeting at least 4 mils thick of sufficient length and width to cover the plastic concrete slab and any edges. The sheeting may be mounted on either the paver or a separate movable bridge from which it can be unrolled without dragging over the plastic concrete surface. When rain appears imminent, all paving operations shall stop and all available personnel shall begin covering the surface of the unhardened concrete with the protective covering.

a. Side-Form Construction. Side form sections shall be straight, free from warps, bends, indentations, or other defects. Defective forms shall be removed from the work. Metal side forms shall be used except at end closures and transverse construction joints where straight forms of other suitable material may be used.

Side forms may be built up by rigidly attaching a section to either top or bottom of forms. If such build-up is attached to the top of metal forms, the build-up shall also be metal.

Width of the base of all forms shall be equal to or greater than the specified pavement thickness.

Side forms shall be of sufficient rigidity, both in the form and in the interlocking connection with adjoining forms, that springing will not occur under the weight of subgrading and paving equipment

or from the pressure of the concrete. The Contractor shall provide sufficient forms so that there will be no delay in placing concrete due to lack of forms.

Before placing side forms, the underlying material shall be at the proper grade. Side forms shall have full bearing upon the foundation throughout their length and width of base and shall be placed to the required grade and alignment of the finished pavement. They shall be firmly supported during the entire operation of placing, compacting, and finishing the pavement.

Forms shall be drilled in advance of being placed to line and grade to accommodate tie bars where these are specified.

Immediately in advance of placing concrete and after all subbase operations are completed, side forms shall be trued and maintained to the required line and grade for a distance sufficient to prevent delay in placing.

Side forms shall remain in place at least 12 hours after the concrete has been placed, and in all cases until the edge of the pavement no longer requires the protection of the forms. Curing compound shall be applied to the concrete immediately after the forms have been removed.

Side forms shall be thoroughly cleaned and oiled each time they are used and before concrete is placed against them.

Concrete shall be spread, screeded, shaped and consolidated by one or more self-propelled machines. These machines shall uniformly distribute and consolidate concrete without segregation so that the completed pavement will conform to the required cross-section with a minimum of handwork.

The number and capacity of machines furnished shall be adequate to perform the work required at a rate equal to that of concrete delivery.

Concrete for the full paving width shall be effectively consolidated by internal vibrators without causing segregation. Internal type vibrators' rate of vibration shall be not less than 7,000 cycles per minute. Amplitude of vibration shall be sufficient to be perceptible on the surface of the concrete more than one foot from the vibrating element. The Contractor shall furnish a tachometer or other suitable device for measuring and indicating frequency of vibration.

Power to vibrators shall be connected so that vibration ceases when forward or backward motion of the machine is stopped.

The provisions relating to the frequency and amplitude of internal vibration shall be considered the minimum requirements and are intended to ensure adequate density in the hardened concrete.

b. Consolidation. Concrete shall be consolidated with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. The vibrators shall be inserted into the concrete to a depth that will provide the best full-depth consolidation but not closer to the underlying material than 2 inches. Excessive vibration shall not be permitted. If the vibrators cause visible tracking in the paving lane, the paving operation shall be stopped and equipment and operations modified to prevent it.

Concrete in small, odd-shaped slabs or in isolated locations inaccessible to gang-mounted vibration equipment shall be vibrated with an approved hand-operated immersion vibrator operated from a bridge spanning the area. Vibrators shall not be used to transport or spread the concrete. Hand-operated vibrators shall not be operated in the concrete at one location for more than 20 seconds. Insertion locations for hand-operated vibrators shall be between 6 to 15 inches on centers. For each

paving train, at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators shall be maintained at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) shall require the immediate stopping of the paving operation and adjustment of the equipment or procedures as approved by the ENGINEER.

If a lack of consolidation of the concrete is suspected by the ENGINEER, referee testing may be required. Referee testing of hardened concrete will be performed by the ENGINEER by cutting cores from the finished pavement after a minimum of 24 hours curing. Density determinations will be made by the ENGINEER based on the water content of the core as taken. ASTM C642 shall be used for the determination of core density in the saturated-surface dry condition. When required, referee cores will be taken at the minimum rate of one for each 500 cubic yards of pavement, or fraction. The Contractor shall be responsible for all referee testing cost if they fail to meet the required density.

The average density of the cores shall be at least 97% of the original mix design density, with no cores having a density of less than 96% of the original mix design density. Failure to meet the referee tests will be considered evidence that the minimum requirements for vibration are inadequate for the job conditions. Additional vibrating units or other means of increasing the effect of vibration shall be employed so that the density of the hardened concrete conforms to the above requirements.

501-4.9 Strike-Off of Concrete and Placement of Reinforcement. Following the placing of the concrete, it shall be struck off to conform to the cross-section shown on the plans and to an elevation that when the concrete is properly consolidated and finished, the surface of the pavement shall be at the elevation shown on the plans. When reinforced concrete pavement is placed in two layers, the bottom layer shall be struck off to such length and depth that the sheet of reinforcing steel fabric or bar mat may be laid full length on the concrete in its final position without further manipulation. The reinforcement shall then be placed directly upon the concrete, after which the top layer of the concrete shall be placed, struck off, and screeded. If any portion of the bottom layer of concrete has been placed more than 30 minutes without being covered with the top layer or if initial set has taken place, it shall be removed and replaced with freshly mixed concrete at the Contractor's expense. When reinforced concrete is placed in one layer, the reinforcement may be positioned in advance of concrete placement or it may be placed in plastic concrete by mechanical or vibratory means after spreading.

Reinforcing steel, at the time concrete is placed, shall be free of mud, oil, or other organic matter that may adversely affect or reduce bond. Reinforcing steel with rust, mill scale or a combination of both will be considered satisfactory, provided the minimum dimensions, weight, and tensile properties of a hand wire-brushed test specimen are not less than the applicable ASTM specification requirements.

501-4.10 Joints. Joints shall be constructed as shown on the plans and in accordance with these requirements. All joints shall be constructed with their faces perpendicular to the surface of the pavement and finished or edged as shown on the plans. Joints shall not vary more than 1/2 inch from their designated position and shall be true to line with not more than 1/4 inch variation in 10 feet. The surface across the joints shall be tested with a 12 feet straightedge as the joints are finished and any irregularities in excess of 1/4 inch shall be corrected before the concrete has hardened. All joints shall be so prepared, finished, or cut to provide a groove of uniform width and depth as shown on the plans.

a. Construction. Longitudinal construction joints shall be slip-formed or formed against side forms as shown in the plans.

Transverse construction joints shall be installed at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for more than 30 minutes or it appears that the concrete will obtain its initial set before fresh concrete arrives. The installation of the joint shall be located at a planned contraction or expansion joint. If placing of the concrete is stopped, the Contractor shall remove the excess concrete back to the previous planned joint.

b. Contraction. Contraction joints shall be installed at the locations and spacing as shown on the plans. Contraction joints shall be installed to the dimensions required by forming a groove or cleft in the top of the slab while the concrete is still plastic or by sawing a groove into the concrete surface after the concrete has hardened. When the groove is formed in plastic concrete the sides of the grooves shall be finished even and smooth with an edging tool. If an insert material is used, the installation and edge finish shall be according to the manufacturer's instructions. The groove shall be finished or cut clean so that spalling will be avoided at intersections with other joints. Grooving or sawing shall produce a slot at least 1/8 inch wide and to the depth shown on the plans.

c. Isolation (Expansion). Isolation joints shall be installed as shown on the plans. The premolded filler of the thickness as shown on the plans, shall extend for the full depth and width of the slab at the joint, except for space for sealant at the top of the slab. The filler shall be securely staked or fastened into position perpendicular to the proposed finished surface. A cap shall be provided to protect the top edge of the filler and to permit the concrete to be placed and finished. After the concrete has been placed and struck off, the cap shall be carefully withdrawn leaving the space over the premolded filler. The edges of the joint shall be finished and tooled while the concrete is still plastic. Any concrete bridging the joint space shall be removed for the full width and depth of the joint.

d. Tie Bars. Tie bars shall consist of deformed bars installed in joints as shown on the plans. Tie bars shall be placed at right angles to the centerline of the concrete slab and shall be spaced at intervals shown on the plans. They shall be held in position parallel to the pavement surface and in the middle of the slab depth. When tie bars extend into an unpaved lane, they may be bent against the form at longitudinal construction joints, unless threaded bolt or other assembled tie bars are specified. Tie bars shall not be painted, greased, or enclosed in sleeves. When slip-form operations call for tie bars, two-piece hook bolts can be installed.

e. Dowel Bars. Dowel bars or other load-transfer units of an approved type shall be placed across joints as shown on the plans. They shall be of the dimensions and spacings as shown and held rigidly in the middle of the slab depth in the proper horizontal and vertical alignment by an approved assembly device to be left permanently in place. The dowel or load-transfer and joint devices shall be rigid enough to permit complete assembly as a unit ready to be lifted and placed into position. The dowels shall be coated with a bond-breaker or other lubricant recommended by the manufacturer and approved by the ENGINEER.

f. Dowels bars at longitudinal construction joints shall be bonded in drilled holes.

g. Placing Dowels and Tie Bars. The method used in installing and holding dowels in position shall ensure that the error in alignment of any dowel from its required horizontal and vertical alignment after the pavement has been completed will not be greater than 1/8 inch per feet. Except as otherwise specified below, horizontal spacing of dowels shall be within a tolerance of ±5/8 inch. The vertical location on the face of the slab shall be within a tolerance of ±1/2 inch. The vertical alignment of the dowels shall be measured parallel to the designated top surface of the pavement, except for those across the crown or other grade change joints. Dowels across crowns and other joints at grade changes shall be measured to a level surface. Horizontal alignment shall be checked perpendicular to the joint edge. The horizontal alignment shall be checked with a framing square. Dowels and tie bars shall not be placed closer than 0.6 times the dowel bar or tie bar length to the planned joint line. If the last regularly spaced longitudinal dowel or tie bar is closer than that dimension, it shall be moved away from the joint to a location 0.6 times the dowel bar or tie bar length, but not closer than 6 inches to its nearest neighbor. The portion of each dowel intended to move within the concrete or expansion cap shall be wiped clean and coated with a thin, even film of lubricating oil or light grease before the concrete is placed. Dowels shall be installed as specified in the following subparagraphs.

(1) Contraction Joints. Dowels and tie bars in longitudinal and transverse contraction joints within the paving lane shall be held securely in place, as indicated, by means of rigid metal frames or basket assemblies of an approved type. The basket assemblies shall be held securely in the

proper location by means of suitable pins or anchors. Do not cut or crimp the dowel basket tie wires. At the Contractor's option, in lieu of the above, dowels and tie bars in contraction joints shall be installed near the front of the paver by insertion into the plastic concrete using approved equipment and procedures. Approval will be based on the results of a preconstruction demonstration, showing that the dowels and tie bars are installed within specified tolerances.

(2) Construction Joints. Install dowels and tie bars by the cast-in- place or the drill-and-dowel method. Installation by removing and replacing in preformed holes will not be permitted. Dowels and tie bars shall be prepared and placed across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms. The spacing of dowels and tie bars in construction joints shall be as indicated.

(3) Dowels Installed in Isolation Joints and Other Hardened Concrete. Install dowels for isolation joints and in other hardened concrete by bonding the dowels into holes drilled into the hardened concrete. The concrete shall have cured for seven (7) days or reached a minimum compressive strength of 2500 psi before drilling commences. Holes 1/8 inch greater in diameter than the dowels shall be drilled into the hardened concrete using rotary-core drills. Rotary-percussion drills may be used, provided that excessive spalling does not occur to the concrete joint face. Modification of the equipment and operation shall be required if, in the ENGINEER's opinion, the equipment and/or operation is causing excessive damage. Depth of dowel hole shall be within a tolerance of ±1/2 inch of the dimension shown on the drawings. On completion of the drilling operation, the dowel hole shall be blown out with oil-free, compressed air. Dowels shall be bonded in the drilled holes using epoxy resin. Epoxy resin shall be injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel will not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic grout retention ring fitted around the dowel. Dowels required to be installed in any joints between new and existing concrete shall be grouted in holes drilled in the existing concrete, all as specified above.

h. Sawing of Joints. Joints shall be cut as shown on the plans. Equipment shall be as described in paragraph 501-4.1. The circular cutter shall be capable of cutting a groove in a straight line and shall produce a slot at least 1/8 inch wide and to the depth shown on the plans. The top of the slot shall be widened by sawing to provide adequate space for joint sealers as shown on the plans. Sawing shall commence, without regard to day or night, as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling, or tearing and before uncontrolled shrinkage cracking of the pavement occurs and shall continue without interruption until all joints have been sawn. The joints shall be sawn at the required spacing. All slurry and debris produced in the sawing of joints shall be removed by vacuuming and washing. Curing compound or system shall be reapplied in the initial sawcut and maintained for the remaining cure period.

501-4.11 Finishing. Finishing operations shall be a continuing part of placing operations starting immediately behind the strike-off. Initial finishing shall be provided by the transverse screed or extrusion plate. The sequence of operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Finishing shall be by the machine method. The hand method shall be used only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing, shall be immediately stopped and proper adjustments made or the equipment replaced. Any operations which produce more than 1/8 inch of mortar-rich surface (defined as deficient in plus U.S. No. 4 sieve size aggregate) shall be halted immediately and the equipment, mixture, or procedures modified as necessary. Compensation shall be made for surging behind the screeds or extrusion plate and settlement during hardening and care shall be taken to ensure that paving and finishing machines are properly adjusted so that the finished surface

of the concrete (not just the cutting edges of the screeds) will be at the required line and grade. Finishing equipment and tools shall be maintained clean and in an approved condition. At no time shall water be added to the surface of the slab with the finishing equipment or tools, or in any other way, except for fog (mist) sprays specified to prevent plastic shrinkage cracking.

a. Machine Finishing with Fixed Forms. The machine shall be designed to straddle the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

b. Other Types of Finishing Equipment. Clary screeds, other rotating tube floats, or bridge deck finishers are not allowed on mainline paving, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to the ENGINEER's approval.

   Bridge deck finishers shall have a minimum operating weight of 7500 pounds and shall have a transversely operating carriage containing a knock-down auger and a minimum of two immersion vibrators. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

c. Hand Finishing. Hand finishing methods will not be permitted, except under the following conditions: (1) in the event of breakdown of the mechanical equipment, hand methods may be used to finish the concrete already deposited on the grade and (2) in areas of narrow widths or of irregular dimensions where operation of the mechanical equipment is impractical. Use hand finishing operations only as specified below.

   (1) Equipment and Screed. In addition to approved mechanical internal vibrators for consolidating the concrete, provide a strike-off and tamping screed and a longitudinal float for hand finishing. The screed shall be at least one foot longer than the width of pavement being finished, of an approved design, and sufficiently rigid to retain its shape, and shall be constructed of metal or other suitable material shod with metal. The longitudinal float shall be at least 10 feet long, of approved design, and rigid and substantially braced, and shall maintain a plane surface on the bottom. Grate tampers (jitterbugs) shall not be used.

   (2) Finishing and Floating. As soon as placed and vibrated, the concrete shall be struck off and screeded to the crown and cross-section and to such elevation above grade that when consolidated and finished, the surface of the pavement will be at the required elevation. In addition to previously specified complete coverage with handheld immersion vibrators, the entire surface shall be tamped with the strike-off and tamping template, and the tamping operation continued until the required compaction and reduction of internal and surface voids are accomplished. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally from bridges resting on the side forms and spanning but not touching the concrete. If necessary, additional concrete shall be placed, consolidated and screeded, and the float operated until a satisfactory surface has been produced. The floating operation shall be advanced not more than half the length of the float and then continued over the new and previously floated surfaces.

d. Straightedge Testing and Surface Correction. After the pavement has been struck off and while the concrete is still plastic, it shall be tested for trueness with a Contractor furnished 12-foot straightedge swung from handles 3 feet longer than one-half the width of the slab. The straightedge shall be held in contact with the surface in successive positions parallel to the centerline and the whole area gone over from one side of the slab to the other, as necessary. Advancing shall be in successive stages of not more than one-half the length of the straightedge. Any excess water and laitance in excess of 1/8 inch thick shall be removed from the surface of the pavement and wasted. Any depressions shall

be immediately filled with freshly mixed concrete, struck off, consolidated, and refinished. High areas shall be cut down and refinished. Special attention shall be given to assure that the surface across joints meets the smoothness requirements of paragraph 501-5.2e(3). Straightedge testing and surface corrections shall continue until the entire surface is found to be free from observable departures from the straightedge and until the slab conforms to the required grade and cross-section. The use of long-handled wood floats shall be confined to a minimum; they may be used only in emergencies and in areas not accessible to finishing equipment. This straight-edging is not a replacement for the straightedge testing of paragraph 501-5.2e(3), Smoothness.

501-4.12 Surface Texture. The surface of the pavement shall be finished with either a brush or broom, burlap drag, or artificial turf finish for all newly constructed concrete pavements. It is important that the texturing equipment not tear or unduly roughen the pavement surface during the operation. Any imperfections resulting from the texturing operation shall be corrected to the satisfaction of the ENGINEER.

a. Brush or Broom Finish. If the pavement surface texture is to be a type of brush or broom finish, it shall be applied when the water sheen has practically disappeared. The equipment shall operate transversely across the pavement surface, providing corrugations that are uniform in appearance and approximately 1/16 inch in depth.

b. Burlap Drag Finish. If a burlap drag is used to texture the pavement surface, it shall be at least 15 ounces per square yard. To obtain a textured surface, the transverse threads of the burlap shall be removed approximately one foot from the trailing edge. A heavy buildup of grout on the burlap threads produces the desired wide sweeping longitudinal striations on the pavement surface. The corrugations shall be uniform in appearance and approximately 1/16 inch in depth.

c. Artificial Turf Finish. If artificial turf is used to texture the surface, it shall be applied by dragging the surface of the pavement in the direction of concrete placement with an approved full-width drag made with artificial turf. The leading transverse edge of the artificial turf drag will be securely fastened to a lightweight pole on a traveling bridge. At least 2 feet of the artificial turf shall be in contact with the concrete surface during dragging operations. A variety of different types of artificial turf are available and approval of any one type will be done only after it has been demonstrated by the Contractor to provide a satisfactory texture. One type that has provided satisfactory texture consists of 7,200 approximately 0.85 inch-long polyethylene turf blades per square foot. The corrugations shall be uniform in appearance and approximately 1/16 inch in depth.

501-4.13 Curing. Immediately after finishing operations are completed and marring of the concrete will not occur, the entire surface of the newly placed concrete shall be cured for a 7-day cure period in accordance with one of the methods below. Failure to provide sufficient cover material of whatever kind the Contractor may elect to use, or lack of water to adequately take care of both curing and other requirements, shall be cause for immediate suspension of concreting operations. The concrete shall not be left exposed for more than 1/2 hour during the curing period.

When a two-sawcut method is used to construct the contraction joint, the curing compound shall be applied to the sawcut immediately after the initial cut has been made. The sealant reservoir shall not be sawed until after the curing period has been completed. When the one cut method is used to construct the contraction joint, the joint shall be cured with wet rope, wet rags, or wet blankets. The rags, ropes, or blankets shall be kept moist for the duration of the curing period.

a. Impervious Membrane Method. The entire surface of the pavement shall be sprayed uniformly with white pigmented curing compound immediately after the finishing of the surface and before the set of the concrete has taken place. The curing compound shall not be applied during rainfall. Curing compound shall be applied by mechanical sprayers under pressure at the rate of one gallon to not more than 150 sq ft. The spraying equipment shall be of the fully atomizing type equipped with a tank agitator. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. During application the compound shall be

stirred continuously by mechanical means. Hand spraying of odd widths or shapes and concrete surfaces exposed by the removal of forms will be permitted. When hand spraying is approved by the ENGINEER, a double application rate shall be used to ensure coverage. The curing compound shall be of such character that the film will harden within 30 minutes after application. Should the film become damaged from any cause, including sawing operations, within the required curing period, the damaged portions shall be repaired immediately with additional compound or other approved means. Upon removal of side forms, the sides of the exposed slabs shall be protected immediately to provide a curing treatment equal to that provided for the surface. Curing shall be applied immediately after the bleed water is gone from the surface.

b. White Burlap-Polyethylene Sheets. The surface of the pavement shall be entirely covered with the sheeting. The sheeting used shall be such length (or width) that it will extend at least twice the thickness of the pavement beyond the edges of the slab. The sheeting shall be placed so that the entire surface and both edges of the slab are completely covered. The sheeting shall be placed and weighted to remain in contact with the surface covered, and the covering shall be maintained fully saturated and in position for seven (7) days after the concrete has been placed.

c. Water Method. The entire area shall be covered with burlap or other water absorbing material. The material shall be of sufficient thickness to retain water for adequate curing without excessive runoff. The material shall be kept wet at all times and maintained for seven (7) days. When the forms are stripped, the vertical walls shall also be kept moist. It shall be the responsibility of the Contractor to prevent ponding of the curing water on the subbase.

d. Concrete Protection for Cold Weather. The concrete shall be maintained at an ambient temperature of at least 50°F for a period of 72 hours after placing and at a temperature above freezing for the remainder of the curing time. The Contractor shall be responsible for the quality and strength of the concrete placed during cold weather; and any concrete damaged shall be removed and replaced at the Contractor's expense.

e. Concrete Protection for Hot Weather. Concrete should be continuous moisture cured for the entire curing period and shall commence as soon as the surfaces are finished and continue for at least 24 hours. However, if moisture curing is not practical beyond 24 hours, the concrete surface shall be protected from drying with application of a liquid membrane-forming curing compound while the surfaces are still damp. Other curing methods may be approved by the ENGINEER.

501-4.14 Removing Forms. Unless otherwise specified, forms shall not be removed from freshly placed concrete until it has hardened sufficiently to permit removal without chipping, spalling, or tearing. After the forms have been removed, the sides of the slab shall be cured as per the methods indicated in paragraph 501-4.13. Major honeycombed areas shall be considered as defective work and shall be removed and replaced in accordance with paragraph 501-5.2(f).

501-4.15 Deleted.

501-4.16 Sealing Joints. The joints in the pavement shall be sealed in accordance with Item 020-605.

501-4.17 Protection of Pavement. The Contractor shall protect the pavement and its appurtenances against both public traffic and traffic caused by the Contractor's employees and agents until accepted by the ENGINEER. This shall include watchmen to direct traffic and the erection and maintenance of warning signs, lights, pavement bridges, crossovers, and protection of unsealed joints from intrusion of foreign material, etc. Any damage to the pavement occurring prior to final acceptance shall be repaired or the pavement replaced at the Contractor's expense.

Aggregates, rubble, or other similar construction materials shall not be placed on airfield pavements. Traffic shall be excluded from the new pavement by erecting and maintaining barricades and signs until the concrete is at least seven (7) days old, or for a longer period if directed by the ENGINEER.

In paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment will be permitted on the new pavement after the pavement has been cured for seven (7) days and the joints have been sealed or otherwise protected, and the concrete has attained a minimum field cured compressive strength of 3500 psi and approved means are furnished to prevent damage to the slab edge.

All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean, and spillage of concrete or other materials shall be cleaned up immediately upon occurrence.

Damaged pavements shall be removed and replaced at the Contractor's expense. Slabs shall be removed to the full depth, width, and length of the slab.

501-4.18 Opening to Construction Traffic. The pavement shall not be opened to traffic until test specimens molded and cured in accordance with ASTM C31 have attained a compressive strength of 3500 psi when tested in accordance with ASTM C39. If such tests are not conducted, the pavement shall not be opened to traffic until 14 days after the concrete was placed. Prior to opening the pavement to construction traffic, all joints shall either be sealed or protected from damage to the joint edge and intrusion of foreign materials into the joint. As a minimum, backer rod or tape may be used to protect the joints from foreign matter intrusion.

501-4.19 Repair, Removal, or Replacement of Slabs.

a. General. New pavement slabs that are broken or contain cracks or are otherwise defective or unacceptable shall be removed and replaced or repaired, as directed by the ENGINEER and as specified hereinafter at no cost to the OWNER. Spalls along joints shall be repaired as specified. Removal of partial slabs is not permitted. Removal and replacement shall be full depth, shall be full width of the slab, and the limit of removal shall be normal to the paving lane and to each original transverse joint. The ENGINEER will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be 4 inch diameter, shall be drilled by the Contractor and shall be filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin, using approved procedures. Drilling of cores and refilling holes shall be at no expense to the OWNER. All epoxy resin used in this work shall conform to ASTM C881, Type V. Repair of cracks as described in this section shall not be allowed if in the opinion of the ENGINEER the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of cracks shall be allowed in any panel that demonstrates segregated aggregate with an absence of coarse aggregate in the upper 1/8 inch of the pavement surface.

b. Shrinkage Cracks. Shrinkage cracks, which do not exceed 4 inches in depth, shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1, using procedures as approved by the ENGINEER. Care shall be taken to assure that the crack is not widened during epoxy resin injection. All epoxy resin injection shall take place in the presence of the ENGINEER. Shrinkage cracks, which exceed 4 inches in depth, shall be treated as full depth cracks in accordance with paragraphs 4.19b and 4.19c.

c. Slabs with Cracks Through Interior Areas. Interior area is defined as that area more than 6 inches from either adjacent original transverse joint. The full slab shall be removed and replaced at no cost to the OWNER, when there are any full depth cracks, or cracks greater than 4 inches in depth, that extend into the interior area.

d. Cracks Close to and Parallel to Joints. All cracks essentially parallel to original joints, extending full depth of the slab, and lying wholly within 6 inches either side of the joint shall be treated as specified here. Any crack extending more than 6 inches from the joint shall be treated as specified

above in subparagraph c.

(1) Full Depth Cracks Present, Original Joint not Opened. When the original un-cracked joint has not opened, the crack shall be sawed and sealed, and the original joint filled with epoxy resin as specified below. The crack shall be sawed with equipment specially designed to follow random cracks. The reservoir for joint sealant in the crack shall be formed by sawing to a depth of 3/4 inches, ±1/16 inch, and to a width of 5/8 inch, ±1/8 inch. Any equipment or procedure which causes raveling or spalling along the crack shall be modified or replaced to prevent such raveling or spalling. The joint sealant shall be a liquid sealant as specified. Installation of joint seal shall be as specified for sealing joints or as directed. If the joint sealant reservoir has been sawed out, the reservoir and as much of the lower saw cut as possible shall be filled with epoxy resin, Type IV, Grade 2, thoroughly tooled into the void using approved procedures.

If only the original narrow saw cut has been made, it shall be cleaned and pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. If filler type material has been used to form a weakened plane in the transverse joint, it shall be completely sawed out and the saw cut pressure injected with epoxy resin, Type IV, Grade 1, using approved procedures. Where a parallel crack goes part way across paving lane and then intersects and follows the original joint which is cracked only for the remained of the width, it shall be treated as specified above for a parallel crack, and the cracked original joint shall be prepared and sealed as originally designed.

(2) Full Depth Cracks Present, Original Joint Also Cracked. At a joint, if there is any place in the lane width where a parallel crack and a cracked portion of the original joint overlap, the entire slab containing the crack shall be removed and replaced for the full lane width and length.

e. Removal and Replacement of Full Slabs. Where it is necessary to remove full slabs, unless there are dowels present, all edges of the slab shall be cut full depth with a concrete saw. All saw cuts shall be perpendicular to the slab surface. If dowels, or tie bars are present along any edges, these edges shall be sawed full depth just beyond the end of the dowels or tie bars. These joints shall then be carefully sawed on the joint line to within one inch of the depth of the dowel or tie bar.

The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. Suitable equipment shall be used to provide a truly vertical lift, and approved safe lifting devices used for attachment to the slabs. The narrow strips along doweled edges shall be carefully broken up and removed using light, hand-held jackhammers, 30 lb or less, or other approved similar equipment.

Care shall be taken to prevent damage to the dowels, tie bars, or to concrete to remain in place. The joint face below dowels shall be suitably trimmed so that there is not abrupt offset in any direction greater than 1/2 inch and no gradual offset greater than one inch when tested in a horizontal direction with a 12-foot straightedge.

No mechanical impact breakers, other than the above hand-held equipment shall be used for any removal of slabs. If underbreak between 1-1/2 and 4 inches deep occurs at any point along any edge, the area shall be repaired as directed before replacing the removed slab. Procedures directed will be similar to those specified for surface spalls, modified as necessary.

If underbreak over 4 inches deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels or tie bars, or where they have been damaged, dowels or tie bars of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete using procedures as specified. Original damaged dowels or tie bars shall be cut off flush with the joint face. Protruding portions of dowels shall be painted and lightly oiled. All four (4) edges of the new slab shall contain dowels or original tie bars.

Placement of concrete shall be as specified for original construction. Prior to placement of new concrete, the underlying material (unless it is stabilized) shall be re-compacted and shaped as specified in the appropriate section of these specifications. The surfaces of all four joint faces shall be cleaned of all loose material and contaminants and coated with a double application of membrane forming curing compound as bond breaker. Care shall be taken to prevent any curing compound from contacting dowels or tie bars. The resulting joints around the new slab shall be prepared and sealed as specified for original construction.

f. Repairing Spalls Along Joints. Where directed, spalls along joints of new slabs, and along parallel cracks used as replacement joints, shall be repaired by first making a vertical saw cut at least one inch outside the spalled area and to a depth of at least 2 inch. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete and at least 1/2 inch of visually sound concrete. The cavity thus formed shall be thoroughly cleaned with high-pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat of epoxy resin, Type III, Grade I, shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Pooling of epoxy resin shall be avoided. The cavity shall be filled with low slump Portland cement concrete or mortar or with epoxy resin concrete or mortar. Concrete shall be used for larger spalls, generally those more than 1/2 cu. ft. in size, and mortar shall be used for the smaller ones. Any spall less than 0.1 cu. ft. shall be repaired only with epoxy resin mortar or a Grade III epoxy resin. Portland cement concrete and mortar mixtures shall be proportioned as directed and shall be mixed, placed, consolidated, and cured as directed. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved by the ENGINEER. The epoxy resin materials shall be placed in the cavity in layers not over 2 inches thick. The time interval between placement of additional layers shall be such that the temperature of the epoxy resin material does not exceed 140°F at any time during hardening. Mechanical vibrators and hand tampers shall be used to consolidate the concrete or mortar. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints, or as required to be routed for cracks. The reservoir shall be thoroughly cleaned and sealed with the sealer specified for the joints. If any spall penetrates half the depth of the slab or more, the entire slab shall be removed and replaced as previously specified If any spall would require over 25% of the length of any single joint to be repaired, the entire slab shall be removed and replaced. Repair of spalls as described in this section shall not be allowed if in the opinion of the ENGINEER the overall condition of the pavement indicates that such repair is unlikely to achieve an acceptable and durable finished pavement. No repair of spalls shall be allowed in any panel that demonstrates segregated aggregate with a significant absence of coarse aggregate in the upper one-eight (1/8th) inch of the pavement surface.

g. Diamond Grinding of PCC Surfaces. Diamond grinding of the hardened concrete with an approved diamond grinding machine should not be performed until the concrete is 14 days or more old and concrete has reached full minimum strength. When required, diamond grinding shall be accomplished by sawing with saw blades impregnated with industrial diamond abrasive. The saw blades shall be assembled in a cutting head mounted on a machine designed specifically for diamond grinding that will produce the required texture and smoothness level without damage to the pavement. The saw blades shall be 1/8-inch wide and there shall be a minimum of 55 to 60 blades per 12 inches of cutting head width; the actual number of blades will be determined by the Contractor and depend on the hardness of the aggregate. Each machine shall be capable of cutting a path at least 3 feet wide. Equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints will not be permitted. The area corrected by diamond grinding the surface of the hardened concrete should not exceed 10% of the total area of any sublot. The depth of diamond grinding shall not exceed 1/2 inch and all areas in which diamond grinding has been performed will

be subject to the final pavement thickness tolerances specified. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. All pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified above, may require removing and replacing in conformance with paragraph 501-4.19.

501-4.20 Existing Concrete Pavement Removal and Repair. All operations shall be carefully controlled to prevent damage to the concrete pavement and to the underlying material to remain in place. All saw cuts shall be made perpendicular to the slab surface.

a. Removal of Existing Pavement Slab. When it is necessary to remove existing concrete pavement and leave adjacent concrete in place, unless there are dowels present, the joint between the removal area and adjoining pavement to stay in place, including dowels or tie bars, shall first be cut full depth with a standard diamond-type concrete saw. If dowels are present at this joint, the saw cut shall be made full depth just beyond the end of dowels. The edge shall then be carefully sawed on the joint line to within one inch of the top of the dowel. Next, a full depth saw cut shall be made parallel to the joint at least 24 inches from the joint and at least 12 inches from the end of any dowels. All pavement between this last saw cut and the joint line shall be carefully broken up and removed using hand-held jackhammers, 30 lb or less, or the approved light-duty equipment which will not cause stress to propagate across the joint saw cut and cause distress in the pavement which is to remain in place. Where dowels are present, care shall be taken to produce an even, vertical joint face below the dowels. If the Contractor is unable to produce such a joint face, or if underbreak or other distress occurs, the Contractor shall saw the dowels flush with the joint. The Contractor shall then install new dowels, of the size and spacing used for other similar joints, by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph 501-4.10g. All this shall be at no additional cost to the OWNER. Dowels of the size and spacing indicated shall be installed as shown on the drawings by epoxy resin bonding them in holes drilled in the joint face as specified in paragraph 501-4.10g. The joint face shall be sawed or otherwise trimmed so that there is no abrupt offset in any direction greater than 1/2 inches and no gradual offset greater than one inch when tested in a horizontal direction with a 12-foot straightedge.

b. Edge Repair. The edge of existing concrete pavement against which new pavement abuts shall be protected from damage at all times. Areas that are damaged during construction shall be repaired at no cost to the OWNER.

(1) Spall Repair. Spalls shall be repaired where indicated and where directed by the ENGINEER. Repair materials and procedures shall be as previously specified in subparagraph 501-4.19f.

(2) Underbreak Repair. All underbreak shall be repaired. First, all delaminated and loose material shall be carefully removed. Next, the underlying material shall be recompacted, without addition of any new material. Finally, the void shall be completely filled with paving concrete, thoroughly consolidated. Care shall be taken to produce an even joint face from top to bottom. Prior to placing concrete, the underlying material shall be thoroughly moistened. After placement, the exposed surface shall be heavily coated with curing compound.

(3) Underlying Material. The underlying material adjacent to the edge and under the existing pavement which is to remain in place shall be protected from damage or disturbance during removal operations and until placement of new concrete, and shall be shaped as shown on the drawings or as directed. Sufficient material shall be kept in place outside the joint line to prevent disturbance (or sloughing) of material under the pavement that is to remain in place. Any material under the portion of the concrete pavement to remain in place, which is disturbed or loses its compaction shall be carefully removed and replaced with concrete as specified in paragraph 501-4.20b(2). The underlying material outside the joint line shall be thoroughly compacted and moist when new concrete is placed.

MATERIAL ACCEPTANCE

501-5.1 Acceptance Sampling and Testing. All acceptance sampling and testing necessary to determine conformance with the requirements specified in this section, including coring for thickness determination, will be performed by the Owner's independent testing laboratory. The Contractor shall bear the cost of providing curing facilities for the strength specimens, per paragraph 501-5.1a(3), and coring and filling operations, per paragraph 501-5.1b(1). Testing organizations performing these tests shall be accredited in accordance with ASTM C1077. The laboratory accreditation must be current and listed on the accrediting authority's website. All test methods required for acceptance sampling and testing must be listed on the lab accreditation.

Concrete shall be accepted for strength and thickness on a lot basis.

A lot shall consist of a day's production not to exceed 1,000 cubic yards.

a. Compressive Strength.

(1) Sampling. Each lot shall be divided into four equal sublots. One sample shall be taken for each sublot from the plastic concrete delivered to the job site. Sampling locations shall be determined by the ENGINEER in accordance with random sampling procedures contained in ASTM D3665. The concrete shall be sampled in accordance with ASTM C172.

(2) Testing. Two (2) specimens shall be made from each sample. Specimens shall be made in accordance with ASTM C31 and the compressive strength of each specimen shall be determined in accordance with ASTM C39. The compressive strength for each sublot shall be computed by averaging the results of the two test specimens representing that sublot.

Immediately prior to testing for compressive strength, the cylinder shall be weighed and measured for determination of a sample unit weight. Measurements shall be made for each dimension; diameter and length, at the mid-point of the specimen and reported to the nearest 1/10 inch. The weight of the specimen shall be reported to the nearest 0.1 pound. The sample unit weight shall be calculated by dividing the sample weight by the calculated volume of the sample. This information shall be reported as companion information to the measured compressive strength for each specimen.

The samples will be transported while in the molds. The curing, except for the initial cure period, will be accomplished using the immersion in saturated lime water method.

Slump, air content, and temperature tests will also be conducted by the quality assurance laboratory for each set of strength test samples, per ASTM C31.

(3) Curing. The Contractor shall provide adequate facilities for the initial curing of cylinders. During the 24 hours after molding, the temperature immediately adjacent to the specimens must be maintained in the range of 60° to 80°F, and loss of moisture from the specimens must be prevented. The specimens may be stored in tightly constructed wooden boxes, damp sand pits, temporary buildings at construction sites, under wet burlap in favorable weather, or in heavyweight closed plastic bags, or using other suitable methods, provided the temperature and moisture loss requirements are met.

(4) Acceptance. Acceptance of pavement for compressive strength will be determined by the ENGINEER in accordance with paragraph 501-5.2b.

b. Pavement Thickness.

(1) Sampling. Each lot shall be divided into four equal sublots and one core shall be taken by the

Contractor for each sublot. Sampling locations shall be determined by the ENGINEER in accordance with random sampling procedures contained in ASTM D3665. Areas, such as thickened edges, with planned variable thickness, shall be excluded from sample locations.

Cores shall be neatly cut with a core drill. The Contractor shall furnish all tools, labor, and materials for cutting samples and filling the cored hole. Core holes shall be filled by the Contractor with a non-shrink grout approved by the ENGINEER within one day after sampling.

(2) Testing. The thickness of the cores shall be determined by the ENGINEER by the average caliper measurement in accordance with ASTM C174.

(3) Acceptance. Acceptance of pavement for thickness shall be determined by the ENGINEER in accordance with paragraph 501-5.2c.

c. Partial Lots. When operational conditions cause a lot to be terminated before the specified number of tests have been made for the lot, or when the Contractor and ENGINEER agree in writing to allow overages or minor placements to be considered as partial lots, the following procedure will be used to adjust the lot size and the number of tests for the lot.

501-5.2 Acceptance Criteria.

a. General. Acceptance will be based on the following characteristics of the completed pavement discussed in paragraph 501-5.2e:

(1) Compressive strength
(2) Thickness
(3) Smoothness
(4) Grade

b. Compressive Strength. Acceptance of each lot of in-place pavement for compressive strength shall be based on the 28-day compressive strength test results for the lot. If the average compressive strength for the lot is at least 98% of the specified strength and no individual test fall below 90% of the specified strength, then the lot will be accepted. Lots with lower average or individual strength results (but no lower than 90% average and/or 80% individual) will be accepted with a contract pay reduction of $30.00 per square yard.

c. Pavement Thickness. Acceptance of each lot of in-place pavement shall be based on the thickness measurements for the lot. If the average thickness for the lot is at least 98% of the specified thickness and no individual test fall below 90% of the specified thickness, then the lot will be accepted. Lots with lower average or individual thickness results (but no lower than 90% average and/or 85% individual) will be accepted with a contract pay reduction of $30.00 per square yard.

d. Smoothness. As soon as the concrete has hardened sufficiently, but not later than 48 hours after placement, the surface of each lot shall be tested in both longitudinal and transverse directions for smoothness to reveal all surface irregularities exceeding the tolerances specified. The Contractor shall furnish paving equipment and employ methods that produce a surface for each section of pavement such that the finished surface of the pavement shall not vary more than 1/4 inch when evaluated with a 12-foot straightedge. When the surface smoothness exceeds specification tolerances which cannot be corrected by diamond grinding of the pavement, full depth removal and replacement of pavement shall be to the limit of the longitudinal placement. Corrections involving diamond grinding will be subject to the final pavement thickness tolerances specified.

(a) Transverse measurements. Transverse measurements will be taken for each lot placed. Transverse measurements will be taken perpendicular to the pavement centerline each 50 feet or more often as determined by the ENGINEER.

(i) Testing shall be continuous across all joints, starting with one-half the length of the straight edge at the edge of pavement section being tested and then moved ahead one-half the length of the straight edge for each successive measurement. Smoothness readings will not be made across grade changes or cross slope transitions; at these transition areas, the straightedge position shall be adjusted to measure surface smoothness and not design grade or cross slope transitions. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Deviations on final pavement > 1/4 inch in transverse direction shall be corrected with diamond grinding per paragraph 501-4.19g or by removing and replacing full depth of pavement. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

(ii) The joint between lots shall be tested separately to facilitate smoothness between lots. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface, with half the straightedge on one side of the joint and the other half of the straightedge on the other side of the joint. Measure the maximum gap between the straightedge and the pavement surface in the area between these two high points. One measurement shall be taken at the joint every 50 feet or more often if directed by the ENGINEER. Maximum gap on final pavement surface > 1/4 inch in transverse direction shall be corrected with diamond grinding per paragraph 501-4.19g or by removing and replacing full depth of surface. Each measurement shall be recorded and a copy of the data shall be furnished to the ENGINEER at the end of each days testing.

(b) Longitudinal measurements. Longitudinal measurements will be taken for each lot placed. Longitudinal tests will be parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the one third points of paving lanes when widths of paving lanes are 20 ft or greater.

(i) Longitudinal Short Sections. Longitudinal Short Sections are when the longitudinal lot length is less than 200 feet and areas not requiring a profilograph. When approved by the ENGINEER, the first and last 15 feet of the lot can also be considered as short sections for smoothness. The finished surface shall not vary more than 1/4 inch when evaluated with a 12-foot straightedge. Smoothness readings will not be made across grade changes or cross slope transitions, at these transition areas, the straightedge position shall be adjusted to measure surface smoothness and not design grade or cross slope transitions. Testing shall be continuous across all joints, starting with one-half the length of the straight edge at the edge of pavement section being tested and then moved ahead one-half the length of the straight edge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Deviations on final pavement surface > 1/4 inch in longitudinal direction will be corrected with diamond grinding per paragraph 501-4.19g or by removing and replacing full depth of surface. Grinding will be tapered in all directions to provide smooth transitions to areas not requiring grinding. The area corrected by grinding should not exceed 10% of the total area and these areas shall be retested after grinding.

e. Grade. An evaluation of the surface grade shall be made by the ENGINEER for compliance to the

tolerances contained below. The finish grade will be determined by running levels at intervals of 50 feet or less longitudinally and all breaks in grade transversely (not to exceed 50 feet) to determine the elevation of the completed pavement. The Contractor shall pay the costs of surveying the level runs, and this work shall be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, shall be provided by the Contractor to the ENGINEER.

a. Lateral Deviation. Lateral deviation from established alignment of the pavement edge shall not exceed ±0.10 feet in any lane.

b. Vertical Deviation. Vertical deviation from established grade shall not exceed ±0.04 feet at any point.

f. Removal and Replacement of Concrete. Any area or section of concrete that is removed and replaced shall be removed and replaced back to planned joints. The Contractor shall replace damaged dowels and the requirements for doweled longitudinal construction joints in paragraph 501-4.10 shall apply to all contraction joints exposed by concrete removal. Removal and replacement shall be in accordance with paragraph 501-4.20.

METHOD OF MEASUREMENT

501-7.1 Portland cement concrete pavement will not be measured for payment, but shall be included in the project lump sum price(s).

TESTING REQUIREMENTS

ASTM C31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39	Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C70	Standard Test Method for Surface Moisture in Fine Aggregate
ASTM C88	Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	Standard Test Method for Materials Finer Than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131	Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136	Standard Test Method for Sieve or Screen Analysis of Fine and Coarse Aggregates
ASTM C138	Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C142	Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143	Standard Test Method for Slump of Hydraulic-Cement Concrete

ASTM C172	Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C174	Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C227	Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method)
ASTM C231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C289	Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method)
ASTM C295	Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C114	Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C311	Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use in Portland Cement Concrete
ASTM C566	Standard Test Method for Total Evaporable Moisture Content of Aggregates by Drying
ASTM C642	Standard Test Method for Density, Absorption, and Voids in Hardened Concrete
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C1077	Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1260	Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1567	Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602	Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
ASTM D3665	Standard Practice for Random Sampling of Construction Materials
ASTM D4791	Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM E178	Standard Practice for Dealing With Outlying Observations

MATERIAL REQUIREMENTS

ASTM A184	Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615	Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A704	Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement
ASTM A706	Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A714	Standard Specification for High-Strength Low-Alloy Welded and Seamless Steel Pipe
ASTM A775	Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A934	Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
ASTM A996	Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1064	Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A1078	Standard Specification for Epoxy-Coated Steel Dowels for Concrete Pavement
ASTM C33	Standard Specification for Concrete Aggregates
ASTM C94	Standard Specification for Ready-Mixed Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C171	Standard Specification for Sheet Materials for Curing Concrete
ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Standard Specification for Chemical Admixtures for Concrete
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C881	Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM D1751	Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D1752	Standard Specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving And Structural Construction
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 305R	Guide to Hot Weather Concreting
ACI 306R	Guide to Cold Weather Concreting
ACI 309R	Guide for Consolidation of Concrete
PCA	Design and Control of Concrete Mixtures

END ITEM 020501

SECTION 020605 - JOINT SEALANTS FOR CONCRETE PAVEMENTS

DESCRIPTION

605-1.1 This item shall consist of providing and installing a resilient and adhesive joint sealing material capable of effectively sealing joints and cracks in rigid pavements.

MATERIALS

605-2.1 Joint Sealants. Joint sealant materials shall meet the requirements of ASTM D5893 Standard Specifications for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.

Each lot or batch of sealant shall be delivered to the jobsite in the manufacturer's original sealed container. Each container shall be marked with the manufacturer's name, batch or lot number, the safe heating temperature, and shall be accompanied by the manufacturer's certification stating that the sealant meets the requirements of this specification.

605-2.2 Backer Rod. The material furnished shall be a compressible, non-shrinking, non-staining, non-absorbing material that is non-reactive with the joint sealant. The material shall have a water absorption of not more than 5% when tested in accordance with ASTM C509. The backer-rod material shall be 25% ± 5 % larger in diameter than the nominal width of the crack.

605-2.3 Backup Materials. Provide backup material that is a compressible, nonshrinking, nonstaining, nonabsorbing material, nonreactive with the joint sealant. The material shall have a melting point at least 5°F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The material shall have a water absorption of not more than 5% of the sample weight when tested in accordance with ASTM C509. The backup material shall be 25 ±5% larger in diameter than the nominal width of the crack.

605-2.4 Bond Breaking Tapes. Provide a bond breaking tape or separating material that is a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. The material shall have a melting point at least 5°F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. The bond breaker tape shall be approximately 1/8 inch wider than the nominal width of the joint and shall not bond to the joint sealant.

CONSTRUCTION METHODS

605-3.1 Time of Application. Joints shall be sealed as soon after completion of the curing period as feasible and before the pavement is opened to traffic, including construction equipment. The pavement temperature shall be 50°F and rising at the time of application of the poured joint sealing material. Do not apply sealant if moisture is observed in the joint.

If the pavement must be opened to traffic prior to placement of the sealant, this paragraph should be modified to require the Contractor to temporarily fill the joint with a jute or nylon rope immediately after the joint is sawed. The rope should be slightly larger than the joint and should be forced into the joint so that the top of the rope is 1/8 inch below the pavement surface. The rope shall be removed immediately prior to cleaning.

605-3.2 Equipment. Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and maintained in satisfactory condition at all times. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 30 days prior to use on the project.

a. Tractor-Mounted Routing Tool. Provide a routing tool, used for removing old sealant from the

joints, of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

b. Concrete Saw. Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified or for refacing joints or cleaning sawed joints where sandblasting does not provide a clean joint.

c. Sandblasting Equipment. Include with the sandblasting equipment an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening should not exceed 1/4 inch. The air compressor shall be portable and capable of furnishing not less than 150 cfm and maintaining a line pressure of not less than 90 psi at the nozzle while in use. Demonstrate compressor capability, under job conditions, before approval. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately one inch above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle as necessary to secure satisfactory results.

d. Waterblasting Equipment. Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. Provide water tank and auxiliary resupply equipment of sufficient capacity to permit continuous operations. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately one inch above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle as necessary to obtain satisfactory results. A pressure gauge mounted at the pump shall show at all times the pressure in psi at which the equipment is operating.

e. Hand Tools. Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

f. Cold-Applied, Single-Component Sealing Equipment. The equipment for installing ASTM D5893 single component joint sealants shall consist of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. The dimension of the nozzle shall be such that the tip of the nozzle will extend into the joint to allow sealing from the bottom of the joint to the top. Maintain the initially approved equipment in good working condition, serviced in accordance with the supplier’s instructions, and unaltered in any way without obtaining prior approval. Small hand-held air-powered equipment (i.e., caulking guns) may be used for small applications.

605-3.3 Preparation of Joints.

a. Sawing. All joints shall be sawed in accordance with specifications and plan details. Immediately after sawing the joint, the resulting slurry shall be completely removed from joint and adjacent area by flushing with a jet of water, and by use of other tools as necessary.

b. Sealing. Immediately before sealing, the joints shall be thoroughly cleaned of all remaining laitance, curing compound, filler, protrusions of hardened concrete, old sealant and other foreign material from the sides and upper edges of the joint space to be sealed. Cleaning shall be accomplished by sandblasting, tractor-mounted routing equipment, concrete saw and/or waterblaster as specified in paragraph 605-3.2. The newly exposed concrete joint faces and the pavement surface extending a minimum of 1/2 inch from the joint edge shall be sandblasted clean. Sandblasting shall be accomplished in a minimum of two passes. One pass per joint face with the nozzle held at an angle directly toward the joint face and not more than 3 inches from it. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave them completely free of debris and water. The joint faces shall be surface dry when the seal is applied.

c. Back-Up Material. When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a back-up material to prevent the entrance of the sealant below the specified depth. Take care to ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

d. Bond-Breaking Tape. Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, insert a bond-breaker separating tape to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. Securely bond the tape to the bottom of the joint opening so it will not float up into the new sealant.

605-3.4 Installation of Sealants. Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the ENGINEER before sealing is allowed. Sealants shall be installed in accordance with the following requirements:

Immediately preceding, but not more than 50 feet ahead of the joint sealing operations, perform a final cleaning with compressed air. Fill the joints from the bottom up to 1/4 inch ±1/8 inch below the pavement surface. Remove and discard excess or spilled sealant from the pavement by approved methods. Install the sealant in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's instructions. Check the joints frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

605-3.5 Inspection. The Contractor shall inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified at no additional cost to the airport.

605-3.6 Clean-Up. Upon completion of the project, remove all unused materials from the site and leave the pavement in a clean condition.

METHOD OF MEASUREMENT

605-4.1 Joint sealing material will not be measured for payment. The work shall be included in the project lump sum bid pricing.

TESTING REQUIREMENTS

ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
ASTM C509	Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM D1644	Standard Test Methods for Nonvolatile Content of Varnishes

MATERIAL REQUIREMENTS

ASTM D789	Standard Test Method for Determination of Relative Viscosity of Polyamide (PA)
ASTM D5893	Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

END ITEM 020605

SECTION 020620 - TAXILANE AND APRON MARKING

DESCRIPTION

620-1.1 This item shall consist of the preparation and painting of numbers, markings, and stripes on the surface of taxilanes, and aprons, in accordance with these specifications and at the locations shown on the plans, or as directed by the ENGINEER. The terms "paint" and "marking material" as well as "painting" and "application of markings" are interchangeable throughout this specification.

MATERIALS

620-2.1 Materials Acceptance. The Contractor shall furnish manufacturer's certified test reports for materials shipped to the project. The certified test reports shall include a statement that the materials meet the specification requirements. The reports can be used for material acceptance or the ENGINEER may perform verification testing. The reports shall not be interpreted as a basis for payment. The Contractor shall notify the ENGINEER upon arrival of a shipment of materials to the site. All material shall arrive in sealed containers 55 gallons or smaller for inspection by the ENGINEER. Material shall not be loaded into the equipment until inspected by the ENGINEER.

620-2.2 Marking Materials. Paint shall be waterborne, in accordance with the requirements of paragraph 620-2.2a. Paint shall be furnished in colors in accordance with Federal Standard No. 595.

Fed Std. No 595 Color	Number
White	37925
Red	31136
Yellow	33538 or 33655
Black	37038
Pink	1 part 31136 to 2 parts 37925
Green	34108

Waterborne black paint should be used to outline a border at least 6 inch wide around markings on all light colored pavements.

a. Waterborne. Paint shall meet the requirements of Federal Specification TT-P-1952E, Type I or Type II. The non-volatile portion of the vehicle for all paint types shall be composed of a 100% acrylic polymer as determined by infrared spectral analysis.

620-2.3 Reflective Media. Glass beads shall meet the requirements for Federal Specification TT-B-1325D, Type III, gradation A, and shall be used for white and yellow paint markings only. Glass beads shall be treated with all compatible coupling agents recommended by the manufacturers of the paint and reflective media to ensure adhesion and embedment.

CONSTRUCTION METHODS

620-3.1 Weather Limitations. The painting shall be performed only when the surface is dry and when the surface temperature is at least 45°F and rising and the pavement surface temperature is at least 5°F above the dew point or meets the manufacturer's recommendations. Markings shall not be applied when the pavement temperature is greater than 130°F. Markings shall not be applied when the wind speed exceeds 10 mph unless windscreens are used to shroud the material guns.

620-3.2 Equipment. Equipment shall include the apparatus necessary to properly clean the existing surface, a mechanical marking machine, a bead dispensing machine, and such auxiliary hand-painting equipment as may be necessary to satisfactorily complete the job.

The mechanical marker shall be an atomizing spray-type or airless-type marking machine suitable for application of traffic paint. It shall produce an even and uniform film thickness at the required coverage and shall apply markings of uniform cross-sections and clear-cut edges without running or spattering and without over spray.

620-3.3 Preparation of Surface. Immediately before application of the paint, the surface shall be dry and free from dirt, grease, oil, laitance, or other foreign material that would reduce the bond between the paint and the pavement. The area to be painted shall be cleaned by waterblasting, shotblasting, grinding or sandblasting or by other methods as required to remove all contaminants minimizing damage to the pavement surface. Use of any chemicals or impact abrasives during surface preparation shall be approved in advance by the ENGINEER. After the cleaning operations, sweeping, blowing, or rinsing with pressurized water shall be performed to ensure the surface is clean and free of grit or other debris left from the cleaning process.

Paint shall not be applied to Portland cement concrete pavement until the areas to be painted are clean of curing material. Sandblasting or high-pressure water shall be used to remove curing materials.

At least 24 hours prior to remarking existing markings, loose existing markings must be removed such that 90% of the loose existing markings are removed. After removal, the surface shall be cleaned of all residue or debris either with sweeping or blowing with compressed air or both.

Prior to the application of markings, the Contractor shall certify in writing that the surface has been prepared in accordance with the paint manufacturer's requirements, that the application equipment is appropriate for the type of marking paint and that environmental conditions are appropriate for the material being applied. This certification along with a copy of the paint manufacturer's surface preparation and application requirements must be submitted and approved by the ENGINEER prior to the initial application of markings.

620-3.4 Layout of Markings. The proposed markings shall be laid out in advance of the paint application.

Glass beads shall be applied in the following locations:

1. Taxilane centerline markings.
2. Taxilane edge markings.
3. Aircraft parking position lead-in and stop bar lines.
4. Aircraft parking position safety envelope lines.

620-3.5 Application. Paint shall be applied at the locations and to the dimensions and spacing shown on the plans. Paint shall not be applied until the layout and condition of the surface has been approved by the ENGINEER. The edges of the markings shall not vary from a straight line more than 1/2 inch in 50 feet, and marking dimensions and spacings shall be within the following tolerances:

Dimension and Spacing	Tolerance
36 inch or less	±1/2 inch
greater than 36 inch to 6 feet	±1 inch
greater than 6 feet to 60 feet	±2 inch
greater than 60 feet	±3 inch

The paint shall be mixed in accordance with the manufacturer's instructions and applied to the pavement with a marking machine at the rate shown in Table 1. The addition of thinner will not be permitted.

Prior to the initial application of markings, the Contractor shall certify in writing that the surface has been prepared in accordance with the paint manufacturer's requirements, that the application equipment

is appropriate for the marking paint and that environmental conditions are appropriate for the material being applied. This certification along with a copy of the paint manufactures application and surface preparation requirements must be submitted to the ENGINEER prior to the initial application of markings.

New concrete pavements should be allowed to cure for eight to twelve weeks before removing the curing compound and installing permanent markings.

Table 1

Paint Type	Paint Square feet per gallon ft^2/gal	Glass Beads, Type III Pounds per gallon of paint lb/gal
Waterborne	115	10

Glass beads shall be distributed upon the marked areas at the locations shown on the plans to receive glass beads immediately after application of the paint. A dispenser shall be furnished that is properly designed for attachment to the marking machine and suitable for dispensing glass beads. Glass beads shall be applied at the rate shown in Table 1. Glass beads shall not be applied to black paint or green paint. Glass beads shall adhere to the cured paint or all marking operations shall cease until corrections are made. Different bead types shall not be mixed. Regular monitoring of glass bead embedment should be performed.

All emptied containers shall be returned to the paint storage area for checking by the ENGINEER. The containers shall not be removed from the airport or destroyed until authorized by the ENGINEER.

620-3.6 Test Strip. Prior to the full application of airfield markings, the Contractor shall produce a test strip in the presence of the ENGINEER. The test strip shall include the application of a minimum of 5 gallons of paint and application of 50 lbs of Type III glass beads. The test strip shall be used to establish thickness/darkness standard for all markings. The test strip shall cover no more than the maximum area prescribed in Table 1 (e.g., for 5 gallons of waterborne paint shall cover no more than 575 square feet.

620-3.7 Protection and Cleanup. After application of the markings, all markings shall be protected from damage until dry. All surfaces shall be protected from excess moisture and/or rain and from disfiguration by spatter, splashes, spillage, or drippings. The Contractor shall remove from the work area all debris, waste, loose or unadhered reflective media, and by-products generated by the surface preparation and application operations to the satisfaction of the ENGINEER. The Contractor shall dispose of these wastes in strict compliance with all applicable state, local, and Federal environmental statutes and regulations.

620-3.8 Marking Removal. The Contractor will be required to remove existing and/or temporary markings as shown on the plans or as directed. Markings shall be removed by high pressure water blasting or other pre-approved method. The marking removal operation shall not result in any appreciable damage to the pavement surface or to joint sealants (provide masking or cover plates to protect joint sealants).

METHOD OF MEASUREMENT

620-4.1 Paint markings and marking removal will not be measured for payment; the work shall be included in the project lump sum pricing.

TESTING REQUIREMENTS

ASTM C371 Standard Test Method for Wire-Cloth Sieve Analysis of Nonplastic Ceramic Powders

ASTM D92	Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester
ASTM D711	Standard Test Method for No-Pick-Up Time of Traffic Paint
ASTM D968	Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D1652	Standard Test Method for Epoxy Content of Epoxy Resins
ASTM D2074	Standard Test Method for Total, Primary, Secondary, and Tertiary Amine Values of Fatty Amines by Alternative Indicator Method
ASTM D2240	Standard Test Method for Rubber Property - Durometer Hardness
ASTM D7585	Standard Practice for Evaluating Retroreflective Pavement Markings Using Portable Hand-Operated Instruments
ASTM E1710	Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
ASTM E2302	Standard Test Method for Measurement of the Luminance Coefficient Under Diffuse Illumination of Pavement Marking Materials Using a Portable Reflectometer
ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

MATERIAL REQUIREMENTS

ASTM D476	Standard Classification for Dry Pigmentary Titanium Dioxide Products
40 CFR Part 60, Appendix A-7, Method 24	Determination of volatile matter content, water content, density, volume solids, and weight solids of surface coatings
29 CFR Part 1910.1200	Hazard Communication
FED SPEC TT-B-1325D	Beads (Glass Spheres) Retro-Reflective
American Association of State Highway and Transportation Officials (AASHTO) M247	Standard Specification for Glass Beads Used in Pavement Markings
FED SPEC TT-P-1952E	Paint, Traffic and Airfield Marking, Waterborne
FED STD 595	Colors used in Government Procurement
AC 150/5340-1	Standards for Airport Markings

END OF ITEM 020620

SECTION 020660 - WATER DISTRIBUTION - CFPUA SPECIFICATIONS

PART 1 - GENERAL

660-1.1 Summary. Section Includes: Ductile iron water mains, fittings and appurtenances as detailed on the drawings and specified herein.

660-1.2 CFPUA Standard Drawings and Specifications. All materials and work included in the section shall conform to the requirements of the Cape Fear Public Utilities Authority (CFPUA) as prescribed in new CFPUA documents to be finalized by CFPUA and scheduled to be effective on January 1, 2019. The draft final documents dated June 25, 2018 are available on the CFPUA website and include:

Material Specification Manual
Technical Specification Manual
Standard Drawing Details

660-1.3 Requirements. All CFPUA requirements applicable to water distribution main construction for development projects shall apply to this work as a responsibility of and at the expense of the contractor (included in the lump sum bid pricing) including but not limited to administrative requirements (pre-construction meetings, submittals, construction records, close-out documentation, etc.), materials, thrust restraint (restrain all joints plus supplemental thrust blocks at 90 degree bends), earthwork, installation, pressure testing, disinfection and placing into service.

660-1.4 Work under this section will not be measured for payment. The work shall be included in the project lump sum pricing. Any equitable adjustments associated with final changes to the CFPUA documents will be covered by Change Order.

END OF SECTION 020660

SECTION 020701 - PIPE FOR STORM DRAINS

DESCRIPTION

701-1.1 This item shall consist of the construction of pipe culverts and storm drains in accordance with these specifications and in reasonably close conformity with the lines and grades shown on the plans.

MATERIALS

701-2.1 Materials shall meet the requirements shown on the plans and specified below.

701-2.2 Pipe. The pipe shall be of the type called for on the plans and shall be in accordance with the following appropriate requirements:

Reinforced Concrete Pipe: ASTM C76, Class III. Joints shall be rubber o-ring or profile type, conforming to ASTM C443. Each joint shall be wrapped with geotextile fabric, two feet wide, centered on the joint and lapped 12 inches wide over the top of pipe. Fabric shall conform to NCDOT Standard Specifications Section 1056, Type 1.

12" HDPE Pipe: AASHTO M294, double wall (exterior corrugations, smooth interior). Joints shall be watertight meeting the requirements of ASTM D3212. Gaskets shall conform to ASTM F477.

Small Diameter Pipe & Fittings (4" to 12") for roof drain and downspout collectors, foundation drains, contractor option:

Double wall HDPE: AASHTO M294, AASHTO M252, ASTM F2648

PVC: Schedule 80, ASTM D2665, ASTM D1785, ASTM D2466 or AWWA C-900

Foundation Drain Perforations: AASHTO Class II

701-2.3 Concrete. Concrete for pipe cradles shall have a minimum compressive strength of 2000 psi at 28 days and conform to the requirements of ASTM C94.

701-2.4 Rubber Gaskets. Rubber gaskets for rigid pipe shall conform to the requirements of ASTM C443. Rubber gaskets for PVC pipe and polyethylene pipe shall conform to the requirements of ASTM F477.

CONSTRUCTION METHODS

701-3.1 Excavation. The width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe, but it shall not be less than the external diameter of the pipe plus 6 inches on each side. The trench walls shall be approximately vertical.

The Contractor shall comply with all current Federal, state and local rules and regulations governing the safety of men and materials during the excavation, installation and backfilling operations. Specifically, the Contractor shall observe that all requirements of the Occupational Safety and Health Administration (OSHA) relating to excavations, trenching and shoring are strictly adhered to. The width of the trench shall be sufficient to permit satisfactorily jointing of the pipe and thorough compaction of the bedding material under the pipe and backfill material around the pipe, but it shall not be greater than the widths shown on the plans trench detail. The trench bottom shall be shaped to fully and uniformly support the bottom quadrant of the pipe.

Where rock, hardpan, or other unyielding material is encountered, the Contractor shall remove it from below the foundation grade for a depth of at least 8 inch or 1/2 inch for each foot of fill over the top of the pipe (whichever is greater) but for no more than three-quarters of the nominal diameter of the pipe.

The excavation below grade shall be backfilled with selected fine compressible material, such as silty clay or loam, and lightly compacted in layers not over 6 inches in uncompacted depth to form a uniform but yielding foundation.

Where a firm foundation is not encountered at the grade established, due to soft, spongy, or other unstable soil, the unstable soil shall be removed and replaced with approved granular material for the full trench width. The ENGINEER shall determine the depth of removal necessary. The granular material shall be compacted to provide adequate support for the pipe.

The excavation for pipes placed in embankment fill shall not be made until the embankment has been completed to a height above the top of the pipe as shown on the plans.

701-3.2 Bedding. The pipe bedding shall conform to the details on the plans.

701-3.3 Laying Pipe. The pipe laying shall begin at the lowest point of the trench and proceed upgrade. The lower segment of the pipe shall be in contact with the bedding throughout its full length. Bell or groove ends of rigid pipes and outside circumferential laps of flexible pipes shall be placed facing upgrade.

Paved or partially lined pipe shall be placed so that the longitudinal center line of the paved segment coincides with the flow line.

Elliptical and elliptically reinforced concrete pipes shall be placed with the manufacturer's reference lines designating the top of the pipe within five degrees of a vertical plane through the longitudinal axis of the pipe.

701-3.4 Joining Pipe. Joints shall be made with rubber gaskets. Rubber ring gaskets shall be installed to form a flexible watertight seal.

701-3.5 Backfilling. Pipes shall be inspected before any backfill is placed; any pipes found to be out of alignment, unduly settled, or damaged shall be removed and relaid or replaced at the Contractor's expense.

Material for backfill shall be fine, readily compatible soil or granular material selected from the excavation or a source of the Contractor's choosing, meeting the requirements shown in the plan details. It shall not contain frozen lumps, stones that would be retained on a 2-inch sieve, chunks of highly plastic clay, or other objectionable material.

When the top of the pipe is even with or below the top of the trench, the backfill shall be compacted in layers not exceeding 6 inches on each side of the pipe and shall be brought up one foot above the top of the pipe or to natural ground level, whichever is greater. Thoroughly compact the backfill material under the haunches of the pipe without displacing the pipe. Material shall be brought up evenly on each side of the pipe for the full length of the pipe.

When the top of the pipe is above the top of the trench, the backfill shall be compacted in layers not exceeding 6 inches and shall be brought up evenly on each side of the pipe to one foot above the top of the pipe. The width of backfill on each side of the pipe for the portion above the top of the trench shall be equal to twice the pipe's diameter or 12 feet, whichever is less.

All backfill shall be compacted to the density required in the plan details.

It shall be the Contractor's responsibility to protect installed pipes and culverts from damage due to construction equipment operations. The Contractor shall be responsible for installation of any extra strutting or backfill required to protect pipes from the construction equipment.

METHOD OF MEASUREMENT

701-4.1 Storm drain pipes will not be measured for payment; all work shall be included in the project lump sum pricing.

MATERIAL REQUIREMENTS

AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter
ASTM C76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C94	Standard Specification for Ready Mixed Concrete
ASTM C150	Standard Specification for Portland Cement
ASTM C443	Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D1056	Standard Specification for Flexible Cellular Materials Sponge or Expanded Rubber
ASTM D3034	Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D6690	Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F794	Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter

END ITEM 020701

SECTION 020751 - MANHOLES, CATCH BASINS AND INLETS

DESCRIPTION

751-1.1 This item shall consist of construction of manholes, catch basins and inlets in accordance with these specifications, at the specified locations and conforming to the lines, grades, and dimensions shown on the plans or required by the ENGINEER.

MATERIALS

751-2.1 Brick. The brick shall conform to the requirements of ASTM C32, Grade MS.

751-2.2 Mortar. Mortar shall consist of one part Portland cement and two parts sand. The Portland cement shall conform to the requirements of ASTM C150, Type I. The sand shall conform to the requirements of ASTM C144.

751-2.3 Concrete. Plain and reinforced concrete used in structures, connections of pipes with structures, and the support of structures or frames shall conform to the requirements of NCDOT Standard Specifications Section 1000 for Class A concrete.

751-2.4 Precast Concrete Pipe Manhole Rings. Precast concrete pipe manhole rings shall conform to the requirements of ASTM C478. Unless otherwise specified, the risers and offset cone sections shall have an inside diameter of not less than 36 inches (90 cm) nor more than 48 inches. There shall be a gasket between individual sections and sections cemented together with mortar on the inside of the manhole.

751-2.5 Frames, Covers, and Grates. The castings shall conform to one of the following requirements:

a. ASTM A48, Class 35B: Gray iron castings
b. ASTM A47: Malleable iron castings
c. ASTM A27: Steel castings
d. ASTM A283, Grade D: Structural steel for grates and frames
e. ASTM A536, Grade 65-45-12: Ductile iron castings
f. ASTM A897:Austempered ductile iron castings

All castings or structural steel units shall conform to the dimensions shown on the plans and shall be designed to support the loadings, aircraft gear configuration and/or direct loading, specified.

Each frame and cover or grate unit shall be provided with fastening members to prevent it from being dislodged by traffic but which will allow easy removal for access to the structure.

All castings shall be thoroughly cleaned. After fabrication, structural steel units shall be galvanized to meet the requirements of ASTM A123.

751-2.6 Steps. The steps or ladder bars shall be gray or malleable cast iron or galvanized steel. The steps shall be the size, length, and shape shown on the plans and those steps that are not galvanized shall be given a coat of bituminous paint, when directed.

CONSTRUCTION METHODS

751-3.1 Unclassified Excavation.

a. The Contractor shall excavate for structures and footings to the lines and grades or elevations, shown on the plans, or as staked by the Contractor. The excavation shall be of sufficient size to permit the placing of the full width and length of the structure or structure footings shown. The elevations of the bottoms of footings, as shown on the plans, shall be considered as approximately only; and the

ENGINEER may direct, in writing, changes in dimensions or elevations of footings necessary for a satisfactory foundation.

b. Boulders, logs, or any other objectionable material encountered in excavation shall be removed. All rock or other hard foundation material shall be cleaned of all loose material and cut to a firm surface either level, stepped, or serrated, as directed by the ENGINEER. All seams or crevices shall be cleaned out and grouted. All loose and disintegrated rock and thin strata shall be removed. Where concrete will rest on a surface other than rock, the bottom of the excavation shall not be disturbed and excavation to final grade shall not be made until immediately before the concrete or reinforcing is placed.

c. The Contractor shall do all bracing, sheathing, or shoring necessary to implement and protect the excavation and the structure as required for safety or conformance to governing laws.

d. All bracing, sheathing, or shoring involved in the construction of this item shall be removed by the Contractor after the completion of the structure. Removal shall not disturb or damage finished masonry.

e. After excavation is completed for each structure, the Contractor shall notify the ENGINEER. No concrete or reinforcing steel shall be placed until the ENGINEER has approved the depth of the excavation and the character of the foundation material.

751-3.2 Brick Structures.

a. Foundations. A prepared foundation shall be placed for all brick structures after the foundation excavation is completed and accepted. Unless otherwise specified, the base shall consist of reinforced concrete mixed, prepared, and placed in accordance with the requirements of the NCDOT Standard Specifications.

b. Laying Brick. All brick shall be clean and thoroughly wet before laying so that they will not absorb any appreciable amount of additional water at the time they are laid. All brick shall be laid in freshly made mortar. Mortar not used within 45 minutes after water has been added shall be discarded. Retempering of mortar shall not be permitted. An ample layer of mortar shall be spread on the beds and a shallow furrow shall be made in it that can be readily closed by the laying of the brick. All bed and head joints shall be filled solid with mortar. End joints of stretchers and side or cross joints of headers shall be fully buttered with mortar and a shoved joint made to squeeze out mortar at the top of the joint. Any bricks that may be loosened after the mortar has taken its set, shall be removed, cleaned, and relaid with fresh mortar. No broken or chipped brick shall be used in the face, and no spalls or bats shall be used except where necessary to shape around irregular openings or edges; in which case, full bricks shall be placed at ends or corners where possible, and the bats shall be used in the interior of the course. In making closures, no piece of brick shorter than the width of a whole brick shall be used; and wherever practicable, whole brick shall be used and laid as headers.

c. Joints. All joints shall be filled with mortar at every course. Exterior faces shall be laid up in advance of backing. Exterior faces shall be plastered or parged with a coat of mortar not less than 3/8 inch thick before the backing is laid up. Prior to parging, all joints on the back of face courses shall be cut flush. Unless otherwise noted, joints shall be not less than 1/4 inch nor more than 1/2 inch wide and the selected joint width shall be maintained uniform throughout the work.

d. Pointing. Face joints shall be neatly struck, using the weather-struck joint. All joints shall be finished properly as the laying of the brick progresses. When nails or line pins are used the holes shall be immediately plugged with mortar and pointed when the nail or pin is removed.

e. Cleaning. Upon completion of the work all exterior surfaces shall be thoroughly cleaned by scrubbing and washing with water. If necessary to produce satisfactory results, cleaning shall be

done with a 5% solution of muriatic acid which shall then be rinsed off with liberal quantities of water.

f. Curing and Cold Weather Protection. The brick masonry shall be protected and kept moist for at least 48 hours after laying the brick. Brick masonry work or pointing shall not be done when there is frost on the brick or when the air temperature is below 50°F unless the Contractor has, on the project ready to use, suitable covering and artificial heating devices necessary to keep the atmosphere surrounding the masonry at a temperature of not less than 60°F for the duration of the curing period.

751-3.3 Concrete Structures. Concrete structures shall be built on prepared foundations, conforming to the dimensions and shape indicated on the plans. The construction shall conform to the requirements of the NCDOT Standard Specifications. Any reinforcement required shall be placed as indicated on the plans and shall be approved by the ENGINEER before the concrete is placed.

All invert channels shall be constructed and shaped accurately to be smooth, uniform, and cause minimum resistance to flowing water. The interior bottom shall be sloped to the outlet.

751-3.4 Precast Concrete Structures. Precast concrete structures shall conform to ASTM C478. Precast concrete structures shall be constructed on prepared or previously placed slab foundations conforming to the dimensions and locations shown on the plans. All precast concrete sections necessary to build a completed structure shall be furnished. The different sections shall fit together readily. Joints between precast concrete risers and tops shall be full-bedded in cement mortar and shall be smoothed to a uniform surface on both interior and exterior of the structure. The top of the upper precast concrete section shall be suitably formed and dimensioned to receive the metal frame and cover or grate, or other cap, as required. Provision shall be made for any connections for lateral pipe, including drops and leads that may be installed in the structure. The flow lines shall be smooth, uniform, and cause minimum resistance to flow. The metal steps that are embedded or built into the side walls shall be aligned and placed at vertical intervals of 12 inches. When a metal ladder replaces the steps, it shall be securely fastened into position.

751-3.5 Inlet and Outlet Pipes. Inlet and outlet pipes shall extend through the walls of the structures a sufficient distance beyond the outside surface to allow for connections. They shall be cut off flush with the wall on the inside surface of the structure, unless otherwise directed. For concrete or brick structures, mortar shall be placed around these pipes to form a tight, neat connection.

751-3.6 Placement and Treatment of Castings, Frames, and Fittings. All castings, frames, and fittings shall be placed in the positions indicated on the plans or as directed by the ENGINEER, and shall be set true to line and elevation. If frames or fittings are to be set in concrete or cement mortar, all anchors or bolts shall be in place before the concrete or mortar is placed. The unit shall not be disturbed until the mortar or concrete has set.

When frames or fittings are placed on previously constructed masonry, the bearing surface of the masonry shall be brought true to line and grade and shall present an even bearing surface so the entire face or back of the unit will come in contact with the masonry. The unit shall be set in mortar beds and anchored to the masonry as indicated on the plans or as directed by the ENGINEER. All units shall set firm and secure.

After the frames or fittings have been set in final position, the concrete or mortar shall be allowed to harden for seven (7) days before the grates or covers are placed and fastened down.

751-3.7 Installation of Steps. The steps shall be installed as indicated on the plans or as directed by the ENGINEER. When the steps are to be set in concrete, they shall be placed and secured in position before the concrete is placed. When the steps are installed in brick masonry, they shall be placed as the masonry is being built. The steps shall not be disturbed or used until the concrete or mortar has hardened for at

least seven (7) days. After seven (7) days, the steps shall be cleaned and painted, unless they have been galvanized.

When steps are required with precast concrete structures, they shall be cast into the side of the sections at the time the sections are manufactured or set in place after the structure is erected by drilling holes in the concrete and cementing the steps in place.

When steps are required with corrugated metal structures, they shall be welded into aligned position at a vertical spacing of 12 inches.

Instead of steps, prefabricated ladders may be installed. For brick or concrete structures, the ladder shall be held in place by grouting the supports in drilled holes.

751-3.8 Backfilling.

a. After a structure has been completed, the area around it shall be backfilled with approved material, in horizontal layers not to exceed 8 inches in loose depth, and compacted to the density required in Item 020 -152. Each layer shall be deposited evenly around the structure to approximately the same elevation. The top of the fill shall meet the elevation shown on the plans or as directed by the ENGINEER.

b. Backfill shall not be placed against any structure until approved by the ENGINEER. For concrete structures, approval shall not be given until the concrete has been in place seven (7) days, or until tests establish that the concrete has attained sufficient strength to withstand any pressure created by the backfill and placing methods.

751-3.9 Cleaning and Restoration of Site. After the backfill is completed, the Contractor shall dispose of all surplus material, dirt, and rubbish from the site. Surplus dirt may be deposited in embankments, shoulders, or as approved by the ENGINEER. The Contractor shall restore all disturbed areas to their original condition. The Contractor shall remove all tools and equipment, leaving the entire site free, clear, and in good condition.

METHOD OF MEASUREMENT

751-4.1 Manholes, catch basins and inlets will not be measured for payment; all work shall be included in the lump sum pricing.

MATERIAL REQUIREMENT

ASTM A27	Standard Specification for Steel Castings, Carbon, for General Application
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A48	Standard Specification for Gray Iron Castings
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A283	Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
ASTM A536	Standard Specification for Ductile Iron Castings
ASTM A897	Standard Specification for Austempered Ductile Iron Castings

ASTM C32	Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C144	Standard Specification for Aggregate for Masonry Mortar
ASTM C150	Standard Specification for Portland Cement
ASTM C478	Standard Specification for Precast Reinforced Concrete Manhole Sections

END OF ITEM 020751

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled. Confirm salvage items with Owner prior to start of demolition.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises.
2. Section 017300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property and for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.

D. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

C. Standards: Comply with ANSI A10.6 and NFPA 241.

1.9 PROJECT CONDITIONS

A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Buildings nearby to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.

1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
2. Do not close or obstruct walkways, exits, or other facilities used by occupants of nearby buildings without written permission from authorities having jurisdiction.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
2. If hazardous materials are present, Owner shall have the following options:
    a. Direct the Contractor to remove the hazardous materials and adjust the Contract Sum by Change Order,
    b. Remove hazardous materials under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Coordinate with Owner for any existing warranties.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.11 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Perform a survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

E. Survey of Existing Conditions: Record existing conditions by use of predemolition photographs.

1. Comply with Section 013233 "Photographic Documentation".
2. Architect-Directed Photographs: From time to time, Architect may request additional photographs. Architect will determine number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of demolition and progress since last photographs were taken.

3.2 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during demolition.

B. Protect existing site improvements to remain from damage during demolition.

1. Restore damaged improvements to their original condition as acceptable to Owner.

C. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

D. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
2. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

E. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures and dust control specified in Section 015000 "Temporary Facilities and Controls."

F. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to nearby occupied buildings.
3. Disconnect, demolish, and remove plumbing and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    f. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
4. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
7. Dispose of demolished items and materials promptly.

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

D. Explosives: Use of explosives is not permitted.

3.5 REPAIRS

A. Promptly repair damage to nearby buildings and related improvements caused by demolition operations.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:

1. Footings.
2. Foundation walls.
3. Slabs-on-grade.
4. Elevated slabs.

B. Related Sections include the following:

1. Section 020152 "Earth Moving" for drainage fill under slabs-on-grade.
2. Section 020501 "Portland Cement Concrete (PCC) Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

1. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

E. Qualification Data: For installer and manufacturer.

F. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Curing compounds.
6. Floor and slab treatments.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Joint-filler strips.
11. Repair materials.

G. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

H. Field quality-control test and inspection reports.

I. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

E. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

F. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 7, "Lightweight Concrete."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

G. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.
e. Special Inspector if Special Inspections are required by the Statement of Special Inpsections.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Products: Subject to compliance with requirements, provide one of the products specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

a. High-density overlay, Class 1 or better.
b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
c. Structural 1, B-B or better; mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Forms for Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

D. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I, II.

a. Fly Ash: ASTM C 618, Class C or F.

B. Normal-Weight Aggregates: ASTM C 33, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4-inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C 330, 3/4-inch nominal maximum aggregate size.

D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.

1. Products:

a. Euclid Chemical Company (The); Eucon CIA.
b. GCP Applied Technologies; DCI.
c. BASF, Inc.; Rheocrete CNI.
d. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

1. Products:

a. Boral Material Technologies, Inc.; Boral BCN2.
b. GCP Applied Technologies; DCI-S.
c. BASF, Inc.; Rheocrete 222+.
d. Sika Corporation; FerroGard-901.

2.7 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A, not less than 15 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

1. Products:

a. Raven Industries Inc.; Vaporblock 15.
b. Reef Industries, Inc.; Griffolyn 15 mils.
c. Stego Industries, LLC; Stego Wrap, 15 mils.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:

a. Burke by Edoco; BurkeFilm.

b. ChemMasters; Spray-Film.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Aquafilm.
d. Dayton Superior Corporation; Sure Film.
e. Euclid Chemical Company (The); Eucobar.
f. Meadows, W. R., Inc.; Sealtight Evapre.
g. Metalcrete Industries; Waterhold.
h. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
i. Sika Corporation, Inc.; SikaFilm.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Products:

a. Burke by Edoco; Aqua Resin Cure.
b. ChemMasters; Safe-Cure Clear.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; W.B. Resin Cure.
d. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
e. Euclid Chemical Company (The); Kurez DR VOX.
f. Meadows, W. R., Inc.; 1100 Clear.
g. US Mix Products Company; US Spec Maxcure Resin Clear.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Products:

a. Burke by Edoco; Cureseal 1315 WB.
b. ChemMasters; Polyseal WB.
c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315 WB.
d. Euclid Chemical Company (The); Super Diamond Clear VOX.
e. Meadows, W. R., Inc.; Vocomp-30.
f. US Mix Products Company; US Spec Radiance UV-25.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.0217-inch- thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.0336 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. See drawings for mix design information.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:

1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Bituminous Vapor Retarders: Place, protect, and repair vapor retarders according to manufacturer's written instructions.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 305 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in 1 direction.

1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces indicated exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than 14 days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector (if required) and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.

    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
5. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31.

    a. Cast and laboratory cure four standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C 39 (6" Ø); test one laboratory-cured specimen at 7 days, two specimens at 28 days, and hold one specimen as reserve for 56 day if required. For 4"Ø specimens, test three at 28 days.

    a. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
13. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units (CMUs).
2. Face brick.
3. Mortar and grout.
4. Reinforcing steel.
5. Masonry joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Cavity-wall insulation.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.
3. Manufactured reglets.
4. Key lock box installed in masonry wall.

C. Related Section:

1. Section 033000 "Cast-In-Place Concrete" for CMU grout.

1.3 DEFINITIONS

A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Trim Units: Show sizes, profiles, and locations of each trim unit required.
3. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples: For each type of the following:

1. Clay face brick.
2. Trim units.
3. Special shapes.

4. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.
5. Weep holes/vents.
6. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

1. Submit list of minimum of five similar projects, including description of project size and scope, and name and contact information for architect, for Installer, superintendent, and crew chiefs. Indicate total years of experience for each.

B. Material Certificates: Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards. Provide for each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For bricks, include size-variation data verifying that actual range of sizes falls within specified tolerances.
c. For exposed brick, include material test report for efflorescence according to ASTM C 67.
d. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Aggregates.
3. Cementitious materials. Include brand, type, and name of manufacturer.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports, per ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with cold-weather and hot-weather requirements.

1.6 QUALITY ASSURANCE

A. Masonry Installer: A single, experienced firm specializing in masonry construction with a minimum five year record of successful completion of projects of similar scope, capable of providing labor and material and performance bonds for its portion of the Work that are acceptable to the Owner. Installer shall furnish all required materials and equipment and perform the work of this Section with its own regular employees.

1. The masonry supervisor/foreman shall have had at least 5 years of experience with at least 5 projects of similar size and nature; he shall not act as or become a production worker.

2. The lead/crew chief masons shall have had at least 3 years of experience with at least 5 projects of similar size and nature;
3. Installer shall have experienced superintendent and crew chiefs on site supervising the work whenever work is in progress.
4. Contractor's Own Forces: Contractor may utilize own forces for work of this Section when Contractor and Contractor's superintendent and crew chiefs meet the above qualifications.

B. Limitations on Aggregates: For concrete masonry units containing recycled material or post-industrial waste, provide units free of impurities that will cause rusting, staining or popouts and with a record of successful in-service performance in conditions similar to those expected at Project site.

1. Ferrous material shall be removed by magnetic separation.
2. Aggregates shall contain no combustible materials or coal cinders.
3. Aggregates shall be graded and supplied in consist graduations from batch to batch.
4. Material shall be tested according to the following:

    a. ASTM C40: Organic Impurities in Fine Aggregates for Concrete.
    b. ASTM C 136: Sieve Analysis of Fine and Coarse Aggregate.
    c. ASTM C 641: Staining Materials in Lightweight Concrete Aggregates.
    d. ASTM C 151: Autoclave Expansion of Hydraulic Cement (for popouts.)
    e. ASTM C 331: Lightweight Aggregates for Concrete Masonry Units

C. Preconstruction Testing Service: Owner may engage a qualified independent testing agency to perform preconstruction testing indicated below. Payment for these services will be made by Owner. Retesting of materials that fail to meet specified requirements shall be done at Contractor's expense.

1. Clay Masonry Unit Test: For each type of unit required, per ASTM C 67.
2. Concrete Masonry Unit Test: For each type of unit required, per ASTM C 140.
3. Grout Test (Compressive Strength): For each mix required, per ASTM C 1019.
4. Mortar Test: For mortar properties per ASTM C 270.
5. Prism Test: For each type of construction required, per ASTM C 1314.

D. Fire-Resistance Ratings: Where indicated, provide materials and construction identical to those of assemblies with fire-resistance ratings determined per ASTM E 119 by a testing and inspecting agency, by equivalent concrete masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Refer to Section 014000 "Quality Requirements" for additional requirements.

1. Build mockups for typical exterior wall in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes and accessories.

    a. Include a sealant-filled joint at least 16 inches long in mockup.
    b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
    c. Include veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.

2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
3. Protect accepted mockups from the elements with weather-resistant membrane.
4. Approval of mockups is for color, texture, and blending of masonry units; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.

b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

F. Daily Log: Maintain a daily log of masonry work in progress for inspection by Owner, Architect, Special Inspector, or Authority Having Jurisdiction.

1. Indicate on small scale plans where masonry was erected.
2. Identify crew and assigned work area.
3. Certify that the following tasks have been performed.

a. Inspection of reinforcing and thru-wall flashings.
b. Inspection of construction and verification of compliance with requirements.
c. Testing of cavity drainage.
d. Daily cleaning.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
2. Where 1 wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

F. Cleaning Masonry Surfaces: Comply with manufacturer's requirements and environmental conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops a net-area compressive strengths (f'_m) of 1,500 psi at 28 days.

B. Determine net-area compressive strength (f'_m) of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

C. Determine net-area compressive strength (f'_m) of masonry by testing masonry prisms according to ASTM C 1314.

2.3 MASONRY UNITS, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to exceed tolerances and to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in the completed Work or will impair the quality of completed masonry.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS (CMUs)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Adams Products
2. Carolina Prestress Corporation
3. E. Dillon & Company
4. Fay Block Materials
5. Cemex
6. Suffolk Block Company
7. Johnson Concrete Company
8. Lightweight Block Co.

B. Concrete Masonry Units: ASTM C 90-14.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.
2. Weight Classification: Lightweight.
3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

C. Shapes: Provide shapes indicated and as follows:

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide square-edged units for outside corners, unless otherwise indicated.
3. Provide bull-nose block for exposed corners on interior walls.

D. Integral Water Repellent: Provide exterior, exposed concrete masonry units made with integral water repellent.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive according to ASTM E 514, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACM Chemistries
b. GCP Applied Technologies
c. Master Builders, Inc./BASF

2.5 BRICK

A. General: Provide shapes indicated and as follows:

1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
3. Provide special shapes for applications requiring brick of size, form, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: ASTM C 216, Grade MW or SW, Type FBS.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 3,350 psi.
2. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested per ASTM C 67.

3. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
4. Product, Size, and Texture: Match existing brick.
5. Application: Use where brick is exposed, unless otherwise indicated.

2.6 MASONRY LINTELS

A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.7 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207.

1. Clay Face Brick: Type N.
2. CMUs: Type S.

C. Portland Cement-Lime Mix: ASTM C 270. Packaged blend of portland cement and hydrated lime containing no other ingredients.

1. Clay Face Brick: Type N.
2. CMUs: Type S.

D. Mortar Cement: ASTM C 1329/C 1329M.

1. Clay Face Brick: Type N.
2. CMUs: Type S.

E. Masonry Cement: Not Permitted.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

a. Products: Subject to compliance with requirements, provide one of the following:

1) Essroc, Italcementi Group; Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
3) Lafarge North America Inc.; Eaglebond Portland & Lime.
4) Lehigh Cement Company.; Lehigh Custom Color Portland/Lime Cement.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
4. Pigments shall not exceed 5 percent of mortar cement by weight.

G. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C 404.

I. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Addiment Incorporated; Mortar Kick
b. BASF Construction Chemicals - Building Systems; Trimix-NCA.
c. Euclid Chemical Company (The); Accelguard 80.
d. GCP Applied Technologies; Morset.
e. Sonneborn, Div. of ChemRex; Trimix-NCA

J. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ACM Chemistries; RainBloc for Mortar.
b. BASF Corporation, Construction Chemicals; Rheopel Mortar Admixture.
c. GCP Applied Technologies; Dry-Block Mortar Admixture.

K. Water: Potable.

2.8 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior Corp., Dur-o-Wal Division; D/A 810, D/A 812, or D/A 817
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

C. Masonry Joint Reinforcement, General: ASTM A 951.

1. Interior Walls: Hot-dip galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: W1.7 or 0.148-inch diameter.
4. Wire Size for Cross Rods: W1.7 or 0.148-inch diameter.
5. Wire Size for Veneer Ties: W1.7 or 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

D. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

E. Masonry Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate ties that extend into facing wythe. Ties have two hooks that

engage eyes or slots in reinforcement and resist movement perpendicular to wall. Ties extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.

2. Continuous Horizontal Masonry Joint Reinforcement for Masonry-Veneer Anchors: Single 0.188-inch diameter, hot-dip galvanized, carbon-steel continuous wire.

    a. Provide at all bed joints in soldier and stacked coursing.

2.9 TIES AND ANCHORS

A. General: Provide 2-piece assemblies allowing vertical or horizontal differential movement between veneer and wall framing parallel to plane of wall but resisting tension and compression forces perpendicular to it, for attachment over sheathing to metal studs, and with the following structural performance characteristics:

1. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in either tension or compression without developing play or deforming more than 0.05 inch.

B. Materials: Provide ties and anchors specified in subsequent paragraphs that are made from materials that comply with subparagraphs below, unless otherwise indicated.

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153/A 153M, Class B-2 coating.
2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, hot-dip galvanized after fabrication to comply with ASTM A 153/A 153M.
4. Stainless-Steel Sheet: ASTM A 666, Type 304.
5. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

D. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.

1. Where wythes are of different materials, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
2. Wire: Fabricate from 3/16-inch diameter, hot-dip galvanized steel wire.

E. Adjustable Anchors for Connecting to Structure: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
2. Tie Section for Steel Frame: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.188-inch diameter, hot-dip galvanized steel wire.

F. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

G. Partition Top Anchors: 0.097-inch thick metal plate with 3/8-inch diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

H. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Screw-Attached Masonry Veneer Anchor: Units consisting of a wire tie and a metal anchor section.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following.

        1) Hohmann & Barnard, Inc.
        2) Dayton Superior Corporation; Dur-O-Wal Division
        3) Heckmann Building Products Inc.
        4) Wire-Bond

    b. Contractor's Option: Provide one of the following types.

        1) Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Fabricate sheet metal anchor section from 1.05 inch thick steel sheet, galvanized after fabrication. Provide self-healing strip under each clip. Basis of Design: Hohmann & Barnard, Inc.; Model # X-Seal.
        2) Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head that covers hole in sheathing. Basis of Design: Heckmann Building Products Inc.; Pos-I-Tie.

2.10 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

B. Postinstalled Anchors: Provide chemical anchors, with capability to sustain, without failure, a load equal to six times the load imposed when installed in solid or grouted unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.

2.11 EMBEDDED FLASHING MATERIALS

A. General: Provide prefabricated corners and end dams of same material and thickness as primary material and from the same flashing manufacturer.

B. Provide minimum 10-inch wide strips of same material under joints.

C. Flexible Flashing: For flashing not exposed to the exterior, use one of the following, unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry. Subject to compliance with requirements, provide one of the following products:

    a. Advanced Building Products Inc.; Copper Fabric Flashing
    b. AFCO Products Inc.; Copper Fabric
    c. Hohmann & Barnard, Inc.; H & B C-Fab Flashing
    d. Phoenix Building Products; Type FCC-Fabric Covered Copper
    e. Polytite Manufacturing Corp.; Copper Fabric Flashing
    f. Sandell Manufacturing Co., Inc.; Copper Fabric Flashing
    g. York Manufacturing, Inc.; York Copper Fabric Flashing

2. Laminated Stainless Steel Fabric Flashing, Non-Asphaltic: Stainless steel core with polymer fabric laminated to one stainless steel face with non-asphalt adhesive. Provide with manufacturer recommended accessory items for a complete compatible system. Subject to compliance with requirements, provide one of the following:

    a. Hohman and Bernard, Inc.; Mighty-Flash Stainless Steel Fabric Flashing.
    b. York Manufacturing, Inc.; Multi-Flash SS
    c. STS Coatings, Inc.; Gorilla Flash Stainless Fabric
    d. Illinois Products, Inc.; IPCO Stainless Steel Fabric Flashing
    e. TK Products, Inc.; TK TWF

3. Self-Adhering Stainless Steel Flashing: 2 mil., Type 304 stainless steel with butyl rubber adhesive on one face. Use where flashing is fully concealed in masonry. Subject to compliance with requirements, provide one of the following:

    a. Hohman and Bernard, Inc.; Mighty-Flash SA.
    b. York Manufacturing, Inc.; York 304 SS.
    c. Illinois Products, Inc.; IPCO Self-Adhering Stainless Steel Fabric Flashing
    d. Vapro Shield, Inc.; Vapro SS Flashing.

D. Partially Exposed Flashing: Stainless steel, minimum 0.016 inch thick.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrate

F. Termination Bar: Stainless steel.

1. Provide stainless steel fasteners.

2.12 MISCELLANEOUS MASONRY ACCESSORIES

A. Pre-Compressed Joint Filler for CMU: Manufacturer's standard preformed, precompressed, closed-cell expanding foam sealant manufactured from 100 percent acrylic and impregnated with a nondrying, water-repellent agent. Factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. EMSEAL Joint Systems, Ltd.; BackerSeal (Basis of Design)
    b. Dayton Superior Specialty Chemicals
    c. Sandell Manufacturing Co., Inc.
    d. Schul International, Inc.
    e. Willseal USA, LLC

B. Compressible Filler for Brick Veneer: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene or urethane.

C. Preformed Control-Joint Gaskets: Material as indicated below, designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

1. Styrene-Butadiene-Rubber Compound: ASTM D 2000, Designation M2AA-805.
2. PVC: ASTM D 2287, Type PVC-65406.

D. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

E. Weep/Vent Products: Use the following, unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.

a. Advanced Building Products Inc.; Mortar Maze weep vent.
b. Dayton Superior Corporation, Dur-O-Wal Division; Cell Vents.
c. Heckmann Building Products Inc.; No. 85 Cell Vent.
d. Hohmann & Barnard, Inc.; Quadro-Vent.
e. Wire-Bond; Cell Vent.

F. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products:

a. Advanced Building Products Inc.; Mortar Break (1 to 1-3/4 inch air space) or Mortar Break II (2-inch airspace).
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop
d. Heckmann Building Products Inc.; Weep-Thru Mortar Deflector.
e. Hohmann & Barnard, Inc.; Mortar Trap.
f. Mortar Net USA, Ltd.; Mortar Net.
g. Wire-Bond; Cavity Net II.

2. Configuration: Provide one of the following:

a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.
b. Strips, not less than 1-1/2 inches thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

2.13 CAVITY-WALL INSULATION

A. Spray Polyurethane Foam Insulation: Refer to Section 072119 "Foamed-In-Place Insulation."

2.14 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.15 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime or mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime or mortar.
4. For reinforced masonry, use portland cement-lime or mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S.
3. For veneer masonry, use Type N.
4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
5. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of mortar cement by weight.
3. Color: Match mortar of existing building.
4. Application: Use pigmented mortar for exposed mortar joints with clay face brick.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Color: Match mortar of existing building.
2. Application: Use colored-aggregate mortar for exposed mortar joints with clay face brick.

F. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar, unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above, unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c., unless otherwise indicated.
3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078446 "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. General: Prepare mortar in accordance with current Portland Cement Association publications.

B. Prepare fresh mortar at the rate it will be used, in order to maintain consistent color and workability. Do not use mortar that has stiffened because of hydration. Discard when not used within the time recommended by mortar manufacturer or PCA publications, whichever is shorter. Retemper mortar carefully to avoid color changes, no more than twice per batch.

C. Measure mortar materials using cubic foot measuring box or other approved container of known volume, of size appropriate for operation. Use a consistent ratio of water to mortar materials, within the range recommended by the mortar manufacturer's written instructions.

1. Measurement of sand by shovel shall not be permitted.

D. Lay hollow brick and concrete masonry units as follows:

1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings. Fully grout all cells at units below grade.
5. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

E. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

3.6 CAVITY WALLS

A. Bond wythes of cavity walls together as follows:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.87 sq. ft. of wall area spaced not to exceed 16 inches o.c. horizontally and 16 inches o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches of openings and space not more than 36 inches apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches o.c. vertically.

a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.

2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement.
c. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) reinforcement to allow for differential movement regardless of whether bed joints align.

3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

C. Installing Cavity-Wall Insulation: Install spray polyurethane foam insulation in accordance with manufacturer's recommendations.

3.7 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Embed in masonry joints.
2. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
3. Space anchors as indicated, but not more than 16 inches o.c. vertically and 16 inches o.c. horizontally at CMU backup and 12 inches o.c. vertically and 24 inches horizontally at light gauge stud backup. Install additional anchors within 12 inches of openings and at intervals, not exceeding 36 inches, around perimeter.

B. Provide not less than 1 inch of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.8 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.

1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

    a. Reinforcement above is in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints, unless otherwise indicated.

C. Provide continuous wire reinforcement in soldier and stacked courses.

D. Provide continuity at wall intersections by using prefabricated T-shaped units.

E. Provide continuity at corners by using prefabricated L-shaped units.

F. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.9 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:

1. Provide an open space not less than 1 inch wide between masonry and structural steel or concrete, unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.

3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using the following method:

1. Install preformed control-joint gaskets designed to fit standard sash block.
2. At veneer side of masonry walls, install pre-compressed joint filler in CMU control joints during CMU installation.

a. Install at depth sufficient to allow installation of properly sized backer rod and liquid sealant in front of joint filler. Comply with manufacturer's written instructions.

1) Install each length of joint filler immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of joint filler requires acceleration to produce seal, apply heat to joint filler in compliance with manufacturer's written instructions.

C. Form expansion joints in brick made from clay as follows:

1. Build in compressible joint fillers where indicated.
2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

A. Install steel lintels where indicated. Secure lintels immediately after placing into position to prevent movement and collapse. Unsecured lintels shall be removed and replaced when they can be secured immediately.

B. Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 16 inches at each jamb, unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of

mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches, and 1-1/2 inches into the inner wythe.
3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
4. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:

1. Use specified weep/vent products to form weep holes.
2. Space weep holes 24 inches o.c., unless otherwise indicated.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in Part 2 "Miscellaneous Masonry Accessories" Article.

3.13 KEY LOCK BOX INSTALLATION

A. Coordinate location with local fire department.

B. Install in accordance with manufacturer's written installation instructions.

3.14 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.15 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports:

1. Payment for these services will be made by Owner.
2. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

C. Water Testing: Upon request of the Architect, and as often as deemed appropriate by the Contractor, the cavity drainage system shall be tested by pouring a 5-gallon bucket of water into the masonry cavity, or use a hose bib, to verify system performance.

D. Flashing Inspections: Prior to concealment by closure of wall, coordinate and schedule inspection of through-wall flashings with Architect.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress/Daily Cleaning: Clean unit masonry as work progresses by scraping off lumps of mortar, wiping down wall surface with burlap bags or equivalent or dry brushing to remove mortar fins and smears before tooling joints. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Examine substrates, areas, and conditions under which masonry cleaning will be performed, for compliance with manufacturer’s and project requirements in order to achieve the approved results.
2. Verify that surfaces and conditions are suitable prior to commencing work of this section.
3. Do not proceed with the work until unsatisfactory conditions have been corrected.
4. Establish by demonstration the pressure to be used, angle of spray and distance of the nozzle from the wall required to properly clean. Maintain this established method throughout the cleaning operation.
5. Test cleaning methods on mock-up wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
6. Prevent overspray, wind drift, and splash onto surfaces not to be treated. Protect adjacent and surrounding surfaces from exposure to the cleaning solution when necessary.
7. Avoid direct contact with building occupants, pedestrians, vehicles and foliage. Cover landscaping using plastic or wet the foliage with water before and after the cleaning process.
8. Avoid wind drifting of spray of chemical cleaning products, residues, and rinse water.
9. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
10. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
11. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20 or low-pressure spray method, using a proprietary acidic cleaner applied according to manufacturer's written instructions.
12. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

A. Masonry Waste: Remove masonry waste and legally dispose of off Owner's property.

1. Comply with Section 017419 "Construction Waste Management and Disposal" for recycling and disposal requirements.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Field-installed shear connectors.
3. Grout.

B. Related Requirements:

1. Section 053100 "Steel Decking" for field installation of shear connectors through deck.
2. Section 055000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.
3. Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the Seismic-Load-Resisting System.
6. Indicate locations and dimensions of protected zones.
7. Identify demand critical welds.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand critical welds.

D. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, professional engineer.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Tension-control, high-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Shop primers.
5. Nonshrink grout.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications (The contractor must meet one of the two following requirements):

1. A qualified fabricator with a minimum of 5 years experience in fabricating structural steel similar to that indicated for this project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the work. The fabricator shall retain, at no cost to the owner, a structural engineer to oversee an inspection process as directed by the engineer of record. The structural engineer shall submit a summary

letter and all supporting documentation to the engineer of record for approval. The letter shall be signed and sealed with an engineering seal for the same state where the project is located and must be approved by the engineer of record prior to fabrication.

a. Fully comply with exception of AISC Certification as provided by NCBC Part 1704.2.2 at the fabricator's expense.

B. Installer Qualifications: A qualified installer and experienced installer who has completed structural steel work similar in material, design, and extent to that indicated for the project and with a record of successful in-service performance for a minimum of 5 years.

C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

D. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Combined system of moment frame and braced frame.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M or ASTM A 572/A 572M, Grade 50.

D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.

1. Weight Class: Standard, unless otherwise noted.
2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.

B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36 or ASTM F 1554, Grade 55, weldable.

1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Plain.

D. Threaded Rods: ASTM A 36/A 36M.

1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM F 436, Type 1, hardened carbon steel.
3. Finish: Plain.

2.4 PRIMER

A. Primer: Comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

B. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 3, "Power Tool Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels, shelf angles, and welded door frames attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.

1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

a. Liquid Penetrant Inspection: ASTM E 165.
b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
c. Ultrasonic Inspection: ASTM E 164.
d. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof deck.
2. Composite floor deck.

B. Related Sections include the following:

1. Section 033000 "Cast-in-Place Concrete" for concrete fill.
2. Section 051200 "Structural Steel Framing" for shop- and field-welded shear connectors.
3. Section 055000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
4. Division 09 painting Sections for repair painting of primed deck.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: For each type of steel deck, signed by product manufacturer.

D. Welding certificates.

E. Field quality-control test and inspection reports.

F. Research/Evaluation Reports: For steel deck.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated.

B. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations of applicable testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

E. FMG Listing: Provide steel roof deck evaluated by FMG and listed in its "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:

a. Consolidated Systems, Inc.
b. New Millennium Building Systems, LLC.
c. Nucor Corp.; Vulcraft Division.
d. Canam Group United Steel Deck, Inc.
e. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

2.2 ROOF DECK-GALVANIZED

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Deck Profile: As indicated.
3. Profile Depth: As indicated.
4. Design Uncoated-Steel Thickness: As indicated.
5. Design Uncoated-Steel Thicknesses; Deck Unit/Bottom Plate: As indicated.
6. Span Condition: As indicated.
7. Side Laps: Overlapped.

2.3 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:

1. Galvanized Steel Sheet: ASTM A 653, Structural Steel (SS), Grade 33, G60 zinc coating.
2. Profile Depth: As indicated.
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Triple span or more.

2.4 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 30 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

H. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.

I. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.

J. Galvanizing Repair Paint: ASTM A 780.

K. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 30, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:

1. Weld Diameter: As Indicated.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
3. Side-Lap and Perimeter Edge Fastening: As Indicated

B. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

C. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:

1. Weld Diameter: As Indicated.
2. Weld Spacing: As Indicated.
3. Side Lap Weld Spacing: Space and locate welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and as follows:

1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Butted.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.

1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
2. Wire brushing, cleaning, and repair painting of bottom deck surfaces are included in Division 09

C. Repair Painting: Wire brushing, cleaning, and repair painting of rust spots, welds, and abraded areas of both deck surfaces are included in Division 09

D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.

B. Related Requirements:

1. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.
2. Section 092216 "Non-Structural Metal Framing" for standard, interior non-load-bearing, metal-stud framing, with height limitations and ceiling-suspension assemblies.

1.3 ACTION SUBMITTALS

A. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

B. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

E. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ClarkDietrich Building Systems
2. Nuconsteel
3. Southeastern Stud & Company
4. Steel Structural Systems

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

   a. Upward and downward movement of 1 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G60.

B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 33.
2. Coating: G60.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.

2. Flange Width: 1 inch plus the design gap for one-story structures.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch.
b. Flange Width: 1 inch plus the design gap for one-story structures.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch
b. Flange Width: Insert dimension equal to sum of outer deflection track flange width plus 1 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch
2. Flange Width: 1-3/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch.
2. Flange Width: 1 inch plus the design gap for one-story structures.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0329 inch.
b. Flange Width: 1 inch.

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: As indicated on Drawings.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel framing and supports for overhead doors, countertops, mechanical and electrical equipment, and applications where framing and supports are not specified in other Sections.
2. Miscellaneous steel trim.
3. Shelf angles.
4. Loose bearing and leveling plates.
5. Metal ladders.
6. Metal bollards.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.3 ACTION SUBMITTALS

A. Product Data: For paint products and grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated Design Submittal: For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified registered professional engineer in the state of North Carolina responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding Certificates: For installer and fabricator for shop and field welds verifying AWS qualification within previous 12 months, submit prior to start of welding.

B. Qualification Data: For professional engineer.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

C. Delegated Design: Design metal fabrications, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Professional engineer shall be legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Anchors, General: Anchors capable of sustaining, without failure, load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing per ASTM E488, conducted by qualified independent testing agency.

C. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 painting Sections.

C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Products:

a. Benjamin Moore; Epoxy Zinc-Rich Primer CM18/19.
b. Carboline Company; Carbozinc 621.
c. ICI Devoe Coatings; Catha-Coat 313.
d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
e. PPG; Aquapon Zinc-Rich Primer 97-670.
f. Sherwin-Williams; Corothane I GalvaPac Zinc Primer.
g. Tnemec Company, Inc.; Tneme-Zinc 90-97.

D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Spray Polyurethane Foam Insulation: Refer to Section 072100 "Thermal Insulation" for spray polyurethane foam insulation to be used in miscellaneous voids and tube steel.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

J. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations and where indicated provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

G. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

H. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.
3. Equip units with integrally welded anchors for casting into concrete or building into masonry.
4. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide x 1/4 inch x 8 inches long.

C. Galvanize exterior miscellaneous framing and supports and where indicated.

D. Prime miscellaneous framing and supports with zinc-rich primer.

2.7 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Galvanize exterior miscellaneous steel trim.

D. Prime miscellaneous steel trim with zinc-rich primer.

2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. Galvanize shelf angles located in exterior walls.

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

C. Prime plates with zinc-rich primer.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

C. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

D. Galvanize loose steel lintels located in exterior walls using G-90 coating.

E. Prime loose steel lintels with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.
2. For ladders in excess of 24 feet in length, provide OSHA compliant ladder safety system or personal fall-arrest system.

B. Steel Ladders:

1. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
2. Space siderails 18 inches apart, unless otherwise indicated.
3. Rungs: 3/4-inch diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted brackets, made from same metal as ladder.
7. Galvanize ladders, including brackets and fasteners.

2.13 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 80 steel pipe.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.

C. Precast Bollard Domes: Provide 5000 psi, fiber-reinforced precast concrete pipe bollard caps with Class A formed finish and symmetrically domed profile.

D. Prime bollards with zinc-rich primer.

2.14 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items unless they are to be embedded in concrete or unless otherwise indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

1. Do not weld, cut, or abrade surfaces of components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Adjust fabrications before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

F. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

G. Corrosion Protection: Coat concealed surfaces of metals that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

H. Connections:

1. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting fabrication components. Use wood blocks and padding to prevent damage to members and fittings.
2. Welded Connections: Use fully welded joints for permanently connecting fabrication components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards in concrete with pipe sleeves preset and anchored into concrete. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch 3 mm toward bollard.

B. Fill bollards solidly with concrete, and install precast bollard cap in accordance with manufacturer's written instructions.

C. Refer to Division 09 for paint requirements.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Extent and Testing Methodology: Testing agency will randomly select completed metal fabrication assemblies for testing that are representative of different designs and conditions in the completed Work. Railings will be tested according to ASTM E 894 and ASTM E 935 for compliance with performance requirements.

C. Remove and replace fabrications where test results indicate that they do not comply with specified requirements unless they can be repaired in a manner satisfactory to Architect and will comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Aluminum pipe and tube railings.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Railing brackets.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Welding certificates.

C. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for

installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not suit structural performance requirements.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Professional engineer shall be legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Tubing: ASTM B 221, Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6. Provide Standard Weight (Schedule 40) pipe unless otherwise indicated.

D. Drawn Seamless Tubing: ASTM B 210, Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209, Alloy 6061-T6.

F. Die and Hand Forgings: ASTM B 247, Alloy 6061-T6.

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.4 FASTENERS

A. General: Provide the following:

1. Aluminum Railings: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components: Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Post-Installed Anchors: Torque-controlled expansion anchors capable of sustaining, without failure, a load equal to 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

1. Material: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Welded Connections for Aluminum Pipe: Fabricate railings to interconnect members with concealed internal welds that eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

J. Form changes in direction as follows:

1. As detailed.
2. By bending or by inserting prefabricated elbow fittings.

K. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Brackets, Flanges, Fittings, and Anchors: Provide brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

O. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

P. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

2.8 ALUMINUM FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with wood or dissimilar metals.

D. Adjust railings before anchoring to ensure matching alignment at abutting joints.

E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with 1/8-inch buildup, sloped away from post.

C. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:

1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.

D. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.4 ATTACHING RAILINGS

A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.

B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.

C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

D. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. Steel-Framed Partitions: At steel framed partitions, use one of the following methods:
    a. Set hanger or lag bolts into wood backing between studs. Coordinate with stud installation to locate backing members.
    b. Self-tapping screws fastened to steel framing or to concealed steel reinforcements.
    c. Toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.5 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wood blocking, cants, and nailers.
2. Plywood backing panels.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
4. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation.

B. Lumber shall be stored off of the ground.

C. Provide for air circulation around stacks and under coverings with breathable tarps.

D. Deliver interior wood materials that are to be exposed to view only after building is enclosed and weatherproof, wet work other than painting is dry, and HVAC system is operating and maintaining temperature and humidity at occupancy levels.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
3. Use Categories:

    a. AWPA U1-UC1: Interior, dry applications, such as furniture, some millwork.
    b. AWPA U1-UC2: Interior, potentially damp applications, such as beams, timbers, flooring, framing, millwork, sill plates.
    c. AWPA U1-UC3A: Exterior, coated not in contact with ground, such as coated millwork, siding, trim.
    d. AWPA U1-UC4A: Exterior, in contact with ground normal, such as fence/deck posts.
    e. AWPA U1-UC5B: Exposed to salt water between NJ and Georgia/south of San Francisco

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, blocking, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber) and AWPA C27 (plywood).

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior: Use type for exterior locations and where indicated.
3. Interior: Use Type A, High Temperature (HT) for enclosed roof framing and where indicated.
4. Interior: Use Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.

C. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

D. Application: Treat all interior and concealed wood blocking in and attached to rated walls and miscellaneous carpentry, unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including blocking, nailers, and cants.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 19 percent maximum moisture content of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Spruce-pine-fir (south) or spruce-pine-fir, Construction or 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
2. Eastern softwoods, No. 2 Common grade; NELMA.

D. For blocking not used for attachment of other construction Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness and fire-retardant treated per AWPA C27.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Use Interior Type A, unless otherwise indicated.
3. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 316 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Wood Screws: ASME B18.6.1.

D. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Do not splice structural members between supports, unless otherwise indicated.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.

D. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

E. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

F. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

G. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.

3.2 WOOD BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

1. Do not use wood blocking in fire-resistance-rated assemblies.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061053

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Flexible flashing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WALL SHEATHING

A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.

1. Product: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corporation; GlasRoc
b. G-P Gypsum Corporation; DensGlass Gold
c. Lafarge North America; Weather Defense Platinum
d. National Gypsum; eXP Sheathing
e. United States Gypsum; Securock

2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 by 96 inches.

2.2 FLEXIBLE FLASHING

A. Opening/Penetration Flashing: Composite, self-adhesive, flashing product consisting of a pliable, rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.040 inch.

1. Products: Subject to compliance with requirements, provide one of the following:

a. GCP Applied Technologies; Vycor V40 Weather Barrier Strips
b. MFM Building Products Corp.; Window Wrap
c. Polyguard Products, Inc.; Polyguard 300
d. Protecto Wrap Company; PW100/40

B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

1. For gypsum wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

1. For steel framing less than 0.0329-inch-thick, attach sheathing to comply with ASTM C 1002.
2. For steel framing from 0.033 to 0.112-inch-thick, attach sheathing to comply with ASTM C 954.

2.4 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

A. Sealant for Glass-Mat Gypsum Sheathing: Elastomeric, neutral-curing silicone joint sealant compatible with joint substrates formed by gypsum sheathing and other materials, recommended by sheathing manufacturer for application indicated and complying with requirements for elastomeric sealants specified in Section 079200 "Joint Sealants."

B. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."

D. Coordinate wall sheathing installation with flashing and joint-treatment installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to cold-formed metal framing with screws.
2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing boards but do not cut into facing.

C. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.

D. Seal sheathing joints according to sheathing manufacturer's written instructions.

1. Apply sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 FLEXIBLE FLASHING INSTALLATION

A. Apply flexible flashing where indicated to comply with manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.

1. Prime substrates as recommended by flashing manufacturer.
2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
3. Lap flashing over water-resistive barrier at head, bottom and sides of openings in accordance with manufacturer's written instructions.
4. Apply flashing to perimeter frame surfaces of windows, storefronts, doors, and miscellaneous penetrations.
5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 061600

SECTION 062023 - INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior plywood paneling.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Samples for Verification:

1. For each species and cut of panel products.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

B. Deliver interior finish carpentry materials only when environmental conditions comply with requirements specified for installation areas. If interior finish carpentry materials must be stored in other than installation areas, store only where environmental conditions comply with requirements specified for installation areas.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, with no added formaldehyde.

1. Face Veneer Species and Cut: Plain-sliced select white birch or select white maple.
   a. Grade: A.
2. Veneer Matching: Selected for similar color and grain.
3. Backing Veneer Species: Any hardwood compatible with face species.
   a. Grade: 3.
4. Construction: Veneer core.
5. Thickness: As indicated on Drawings.
6. Glue Bond: Type II (interior).

2.2 MISCELLANEOUS MATERIALS

A. Fasteners for Interior Finish Carpentry: Nails, screws, and other anchoring devices of type, size, material, and finish required for application indicated to provide secure attachment, concealed where possible.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound; warped; improperly treated or finished; inadequately seasoned; too small to fabricate with proper jointing arrangements; or with defective surfaces, sizes, or patterns.

B. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.
3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
4. Coordinate interior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate interior finish carpentry.

3.4 PANELING INSTALLATION

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels.

1. Attach panels to supports with manufacturer's recommended panel adhesive and fasteners.
2. Space fasteners and adhesive as recommended by panel manufacturer.
3. Install with uniform tight joints between panels.

3.5 ADJUSTING

A. Replace interior finish carpentry that is damaged or does not comply with requirements. Interior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.6 CLEANING

A. Clean interior finish carpentry on exposed and semiexposed surfaces. Restore damaged or soiled areas and touch up factory-applied finishes if any.

3.7 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062023

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plastic-laminate-faced architectural cabinets.
2. Acrylic resin panels.
3. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products, high-pressure decorative laminate, adhesive for bonding plastic laminate, and cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.

C. Samples for Initial Selection:

1. Plastic laminates.
2. Thermoset decorative panels.
3. Acrylic resin panels.

D. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Thermoset decorative panels, 8 by 10 inches, for each color, pattern, and surface finish, with edge banding on one edge.
3. Acrylic resin materials, 12 inches square.
4. Exposed cabinet hardware and accessories, one unit for each type and finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Certificates: For each type of product, signed by product manufacturer.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups of typical plastic-laminate cabinets as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of components or other failures of glue bond.
b. Warping of components.

c. Failure of operating hardware.
d. Deterioration of finishes.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide products by one of the following:

1. Cabinets by Design, Duluth, GA
2. Cleora Sterling
3. LSI Corporation
4. Pridgen Millwork
5. Stephenson Millwork
6. Stevens Industries, Inc.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom.

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. High-Pressure Decorative Laminate **(AA-PLAM-1, UA-PLAM-1,** and **DL-PLAM-1)**: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

1. Color and Pattern: As indicated on Finish Legend.

F. Laminate Cladding for Exposed Surfaces:

1. Horizontal Surfaces: Grade HGS.
2. Vertical Surfaces: Grade VGS.
3. Edges: PVC edge banding, 3 mm thick, matching laminate in color, pattern, and finish.
4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

G. Materials for Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.

a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish.
b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.

2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.

3. Drawer Bottoms: Hardwood plywood.

H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.

I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Cabinet Construction: As required by referenced quality standard, but not less than the following:

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces.
2. Cabinet Joinery: Fixed body members shall be joined using dowels and assembled using glue and pressure.
3. Shelves: 3/4-inch thick particleboard, plastic-laminate faced or thermoset decorative panels.
4. Backs of Cabinets: 1/2-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semiexposed surfaces.
5. Drawer Fronts: 3/4-inch particleboard, plastic-laminate faced.
6. Drawer Sides and Backs: 1/2-inch particleboard or MDF, plastic-laminate faced, with glued dovetail or multiple-dowel joints.
7. Drawer Bottoms: 1/2-inch particleboard or MDF, plastic-laminate faced, glued and dadoed into front, back, and sides of drawers.
8. Doors: 3/4-inch particleboard or MDF, plastic-laminate faced.

K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

2.3 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated. Provide composite wood products with no added formaldehyde.

1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
2. Particleboard: ANSI A208.1, Grade M-2.
3. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
4. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL.

2.4 ACRYLIC RESIN PANELS

A. Acrylic Resin Panels **(AP-1)**:

1. Product, Colors and Patterns: As indicated on Finish Schedule.
2. Thickness: 1/4-inch.
3. Edge Seal: Required.

4. Finish: Sandstone.

2.5 CABINET HARDWARE AND ACCESSORIES

A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.

1. Provide soft-closing hinges.

B. Wire Pulls **(AA-HD-1, UA-HD-1,** and **DL-HD-1)**: Back mounted, stainless steel.

C. Adjustable Shelf Supports: Injection molded transparent poly-carbonate friction fit into cabinet end panels and vertical dividers, adjustable on 32mm centers. Each shelf support has 2 integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The support automatically adapts to 3/4 inch or 1-inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

D. Drawer Slides: BHMA A156.9, Type B05091.

1. Regular, Kneespace, Keyboard and Pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet ball-bearing slides. Positive stop both directions with soft-closing feature. Provide continuous mounting condition for keyboard slides beneath countertops.
2. File: Full extension, no less than 125-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet ball-bearing slides. Positive stop both directions with soft-closing feature.

E. Door and Drawer Locks: Removable core, disc tumbler, cam style lock with strike.

1. Quantity: Two keys per lock.
2. All locks in individual rooms to be keyed alike. Provide master key.

F. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

G. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesive for Bonding Plastic Laminate and Edges: Manufacturer's standard.

2.7 FABRICATION

A. Fabricate cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.

1. Use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 064600 - WOOD TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior standing and running trim.
2. Shop finishing of wood trim.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:

1. Lumber and panel products with shop-applied opaque finish.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products.

1.5 FIELD CONDITIONS

A. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 WOOD TRIM, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.

B. Wood Moisture Content for Interior Materials: 5 to 10 percent.

2.2 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

A. Wood Wall Base:

1. Grade: Custom.
2. Wood Species: Any closed-grain hardwood.
3. Profile: As indicated on Drawings.
4. Size: As indicated on Drawings.

2.3 MISCELLANEOUS MATERIALS

A. Fasteners: Select material, type, size, and finish required for each substrate for secure anchorage.

2.4 FABRICATION

A. Fabricate wood trim to dimensions, profiles, and details indicated.

B. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.

2.5 SHOP FINISHING

A. General: Finish wood trim at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing wood trim, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of wood trim. Apply two coats to end-grain surfaces.

C. Interior Wood Trim for Opaque Finish: Shop prime with one coat of wood primer specified in Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition wood trim to average prevailing humidity conditions in installation areas.

3.2 INSTALLATION

A. Grade: Install wood trim to comply with same grade as item to be installed.

B. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

C. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60

inches long except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.

1. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

END OF SECTION 064600

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board.
2. Glass-fiber blanket.
3. Mineral-wool blanket.

B. Related Requirements:

1. Section 078446 "Fire-Resistive Joint System" for head-of-wall fire-stop sealants used for fire-rated walls.
2. Section 092900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. DiversiFoam Products
    b. Dow Chemical Company
    c. Owens Corning
    d. Pactiv Building Products

2. Thickness: As indicated on Drawings or as required to meet R-value indicated on Drawings.
3. Minimum Compressive Strength: Type IV, 1.55 pcf density, 25 psi.
4. Thermal Resistance, per ASTM C518, at 75 deg. F mean temperature shall be R-5 per inch.

2.2 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed Corporation.
    b. Guardian Building Products, Inc.
    c. Johns Manville; a Berkshire Hathaway company.
    d. Knauf Insulation.
    e. Owens Corning.

2.3 MINERAL-WOOL BLANKETS

A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Industrial Insulation Group, LLC (IIG-LLC); a Johns Manville company
    b. Rockwool
    c. Thermafiber, Inc.; an Owens Corning company

2.4 ACCESSORIES

A. Insulation for Miscellaneous Voids and Head-of-Wall Joints in Non-Rated Walls:

1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

B. Fasteners: Product recommended and approved by insulation manufacturer, with demonstrated capability to secure insulation to substrates indicated without damaging insulation and substrates and complying with other listed performance characteristics.

C. Adhesive for Bonding Insulation: Product recommended and approved by manufacturer, with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

D. Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints between units and filling voids in work.

E. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically.

B. Head-of-Wall Joints in Non-Rated Walls and Miscellaneous Voids:

1. Install insulation in miscellaneous voids, head-of-wall joints in non-rated walls, and cavity spaces where required to prevent gaps in insulation using the following materials:

   a. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

2. Refer to Section 078446 "Fire-Resistive Joint System" for head-of-wall sealant in rated walls.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 072119 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Test Reports: Provide certified test results for ignition barrier based on full-scale SwRI Test Procedure 99-02 or other test acceptable to Authorities Having Jurisdiction.

D. Evaluation Report: For ignition barrier indicating acceptance by Authorities Having Jurisdiction for application intended.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 2.0 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation
b. BaySystems North America, LLC
c. Demilec USA LLC

d. Gaco Western LLC
e. Henry Company
f. Icynene-Lapolla
g. Johns Manville
h. NCFI Polyurethanes; a division of Barnhardt Manufacturing Company

2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2.2 IGNITION BARRIER

A. Provide ignition barrier approved by manufacturer of spray foam insulation, tested AC-377, Appendix X (modified NFPA 286) and acceptable to Authority Having Jurisdiction.

B. Ignition Barrier: Water-based intumescent barrier coating.

1. Products: Subject to compliance with requirements, provide one of the following:

a. International Fireproof Technology, Inc.; DC315
b. Johns Manville; Ignition Barrier IB.
c. Tiger Foam; Ignition Barrier.
d. TPR^2 Corporation; Fireshell F10E

2.3 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.

B. Sealants: As recommended by Spray Polyurethane Foam Insulation manufacturer and as specified in Section 0799200 "Joint Sealants."

C. Foamed-in-Place Sealant: One- or two-component foam sealant conforming to ULC S710.1 or ULS S711.1 and the following:

1. Density: 1.5 to 2.0 pc.
2. Flame Spread: 25 or less per ASTM E84.
3. R-value: Minimum 7.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Miscellaneous Voids: Apply according to manufacturer's written instructions.

3.3 INSTALLATION OF IGNITION BARRIER

A. Comply with manufacturer's written instructions applicable to products and applications.

B. Spray barrier coating to completely cover entire area of insulation indicated to be protected to achieve thickness required by testing and evaluation reports.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 074213.13 - FORMED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal liner panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METAL LINER PANELS

A. General: Provide factory-formed metal liner panels designed for interior side walls and field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for a complete installation.

B. Metal Liner Panels: Solid panels formed with intermediate stiffening ribs symmetrically spaced between panel edges; with a flush joint between panels.

1. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 0.022 inch.
b. Exterior Finish: Two-coat fluoropolymer.
c. Color: As selected by Architect from manufacturer's full range.

2. Panel Coverage: 36 inches.
3. Seam Profile: Flush.
4. Seam Height: 1.5 inches.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

2.5 FINISHES

A. Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.
2. Concealed Finish: White or light-colored acrylic or polyester backer finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.2 METAL PANEL INSTALLATION

A. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

B. Metal Liner Panels: Install panels on interior side of girts with flush appearance on the inside.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

3.3 CLEANING

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 074213.13

SECTION 074213.19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Foamed-insulation-core metal wall panels.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 72:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
4. Potential Heat: Acceptable level when tested according to NFPA 259.

5. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.
2. Trim and Closures: 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: 12-inch- long Samples for each type of accessory.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory- applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FOAMED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.

a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
c. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.
d. Shear Strength: 26 psi when tested according to ASTM C 273/C 273M.

B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and- groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CENTRIA Architectural Systems; Versawall.
b. Firestone; UNA-Foam.
c. Kingspan Insulated Panels; 300 R Striated Panel.
d. Alply Insulated Panels, LLC; Horizontal Classic Wall

2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Nominal Thickness: 0.028 inch.
b. Exterior Finish: Two-coat fluoropolymer.

1) Color: As selected by Architect from manufacturer’s full range.

c. Interior Finish: Manufacturer’s standard.
d. Exterior Surface: Striated and embossed.

3. Backer Board: On back side of exterior facing.
4. Snap-on Batten: Same material, finish, and color as exterior facings of wall panels.
5. Panel Coverage: 36 inches nominal.
6. Panel Thickness: 2.0 inches.

2.2 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.3 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Honeycomb-Core Metal Wall Panels: Fabricate panels using manufacturer's standard thermosetting structural adhesive in a lamination process that bonds panel under minimum 10- psi pressure. Use of contact adhesives with pinch-roll process is unacceptable.

1. Panel Bow Tolerance: Not more than 0.5 percent of panel width or length.

E. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
3. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
4. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.4 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same

piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

    a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.4 INSULATED METAL WALL PANEL INSTALLATION

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.

B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.

1. Install clips to supports with self-tapping fasteners.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types

indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

D. Metal wall panels will be considered defective if they do not pass test and inspections.

E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074213.19

SECTION 075419 - POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Adhered PVC membrane roofing system.
2. Roof insulation.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

1. Roofing system shall comply with design criteria of the North Carolina Building Code, latest edition.

a. Design wind speed is 129 mph.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

1. Windstorm Classification:

a. Field-of-Roof Uplift Pressure: Refer to Structural Drawings for load requirements.
b. Perimeter Uplift Pressure: Refer to Structural Drawings for load requirements.
c. Corner Uplift Pressure: Refer to Structural Drawings for load requirements.

D. Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, that is listed with FM Approvals' "RoofNav", Miami Dade, or Florida Building Code for Class 1, as applicable. Identify materials with submitted assembly Agency Approvals markings.

1. Hail Resistance: MH.
2. Fire: FM 1A or UL Class A.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
5. Indicate roof design of fasteners and specifications to meet wind force loads indicated on the Structural Drawings and in the building code.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Submit name and qualification data for qualified roofing Installer and membrane manufacturer, indicating full compliance with specification requirements. Architect and Owner reserve the right to reject roof Installer and/or membrane manufacturer if documentation of full compliance with specifications is not provided.

1. Submit certificate from manufacturer certifying that Installer has been trained by the manufacturer and is an authorized/certified installer of the specific roof membrane proposed for this Project.
2. The Installer through the Contractor shall submit references, stating satisfactory performance of installation, from five different Architects or Owners for projects that the Installer has completed and have been in service for a minimum of two years. Include complete contact information, also completion date, size and location of project.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

1. Submit evidence of compliance with performance requirements.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

D. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

E. Inspection Report: Copy of roofing system manufacturer's inspection report with written approval as to specification compliance and acceptance of completed roofing system installation.

F. Field quality-control reports.

G. Maintenance Data: For roofing system to include in maintenance manuals.

H. Warranties: Sample of special warranties.

I. Manufacturer’s Application/Installation Instructions.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that has FM, Miami Dade or Florida Building Code Approvals approved for membrane roofing system identical to that used for this Project.

1. A manufacturing firm that has specialized in the manufacture of membrane roofing of the type specified and has been in standard production of the type of membrane specified for at least 10 years.
2. The manufacturer shall provide all materials marketed and labeled by a single source for a complete system; sheet goods, weldable flashings, coated metals, corrosion resistant fastenings, sealants, adhesives, primers, seam caulk, and all other components which may be required for this roof to receive a 20 year warranty.

3. Manufacturer shall provide the technical inspection such that manufacturer's intent and contractor's efforts remain coordinated.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1. The installer shall demonstrate and offer written attested certification that he has installed; a minimum of 500 squares (50,000 sq. ft.) per year for each of the past three years, of the material that he is bidding.

   a. Installation of other types of membranes, or another manufacturer's goods is not considered as meeting the above requirement.
   b. Installer shall have been in business under its present name for at least 5 years prior to start of this project.

2. The installer shall substantiate a track record of the manufacturer's working with the installer, for three consecutive years, and at a scale of operations cited above.
3. The Crew Chief/Foreman, shall be physically on-site, directly supervising the Work, during the entire period of installation of roof membrane.

   a. Crew Chief/Forman shall be trained and certified by the roofing system manufacturer and shall have on their person an identification card, certifying completion of training and approval of the manufacturer for the roofing system being installed. The installer shall have been actively installing the type of roofing system defined in these specifications for a minimum of 3 years.
   b. Quality Incident Rate: Less than 5.0.

C. Source Limitations: Obtain components, including adhesives, for membrane roofing system from same manufacturer as membrane roofing.

1. The roofing system specified herein shall be the warranted system/product of a single manufacturer.
2. The incorporation of products not specifically by the roofing manufacturer shall be recommended and approved by the roofing manufacturer and shall be included within the roofing system warranty.
3. Pre-manufactured roof curbs may carry their own warranty but the flashing of these curbs into the roofing system shall be included in the roofing system warranty.

D. Exterior Fire-Test Exposure: ASTM E 108, UL, & FM, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

F. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening and wind uplift.

5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, and condition of other construction that will affect roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

G. Roofing Inspections: Make required notifications, secure required inspections and pay fees such that the specified systems warranty are assured at the time of completion of the Work.

1. Contractor and Manufacturer’s assigned representative shall inspect and warrant the Work as a condition of acceptance.
2. Manufacturer shall provide project start-up guidance and direction at start of installation and then provide inspections by manufacturer’s technical inspector at 25 percent, 50 percent and final, with inspection reports submitted to the Roofing Installer, General Contractor and Architect/Owner. Deficiencies shall be listed on the inspection reports and all repairs/corrections made and certified completed and approved by the inspector submitted with next and final report.
3. Manufacturer's Final Completion/Warranty Inspection: Upon completion of the Work and prior to final payment, the roofing manufacturer's representative, in the presence of the Owner and Architect, shall inspect the roofing Work. Discrepancies shall be recorded and immediately rectified. Final payment will not be issued until the manufacturer's representative has given his certification/approval of the Work and close-out submittals, including Roofing Warranties and roof maintenance instructions, have been received by the Architect. Warranties issued prior to final inspection are not acceptable and shall not qualify for release of final payment for roofing work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.8 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.9 WARRANTY

A. Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, roofing accessories, manufacturer’s edge metal products and other components of membrane roofing system.
2. Provide manufacturer's standard wind warranty, not less than 60 mph.
3. Warranty Period: 20 years from date of Substantial Completion.
4. System Warranty: As a part of the work of this section, pay all required fees, secure all required inspections, and do all things necessary to secure and deliver to the owner a 20 year Total System Warranty from the manufacturer of the approved materials. The bond shall provide no dollar limit (NDL) liability when all published conditions are met.

B. Warranty Plaque: The Contractor shall provide a roof warranty plaque, to the contractor for mounting on the wall beside the roof access ladder/hatch. The plaque shall have a warning stating the following:

"Prior to making modifications or repairs to the existing roof, approval for modifications and repairs from the manufacturer, must be obtained. All work on existing warranted roofing system shall be performed so as to maintain warranties, work that would void warranties is prohibited. Entities performing work that would void existing roof warranties shall be liable for cost to make necessary repairs, required to reinstate warranties."

1. The plaque shall also contain the name of the manufacturer, serial number of warranty, date of issue of the warranty, length of warranty and names and telephone numbers of manufacturer contacts. Include a copy of the warranty. The plaque shall be covered/protected by a clear acrylic/polycarbonate sheet screwed or other wise attached to substrate of plaque, which shall be sealed wood, plastic or non-corrosive metal. Provide one at each access ladder/hatch.

PART 2 - PRODUCTS

2.1 PVC/KEE MEMBRANE ROOFING

A. PVC/KEE Sheet: ASTM D4434, Type III - polyester fiber reinforced, or ASTM D6754.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Carlisle Syntec Systems; FleeceBack KEE HP
b. Durolast; Durolast EV
c. Flex; FB 60
d. Johns Manville; JM PVC FB
e. Seaman Corporation; FiberTite-SM-FB
f. Versico; Versifleece KEE HP FRS

2. Thickness: 60 mils, nominal for ASTM D4434 and 45 mils for ASTM D6754.
3. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet membrane.

C. Bonding Adhesive: Manufacturer's standard.

D. Slip Sheet (if required by Manufacturer): Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Metal Battens (if required by Manufacturer): Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.3 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated and that produce FM Approvals-approved roof insulation.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class I, Grade 3, felt or glass-fiber mat facer on both major surfaces.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.4 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Provide as recommended by insulation manufacturer:

1. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.
2. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low-rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

3. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray-applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 1/2 inch or greater as required to meet manufacturer's wind uplift and warranty requirements.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Georgia-Pacific Corporation; Dens Deck Prime.
b. National Gypsum; DEXcell
c. United States Gypsum; Securock.
d. Roofing membrane manufacturer's tested, approved, and warranted cover board that is equivalent to specified product.

2.5 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads or rolls, approximately 3/16-inch-thick and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and that roof drain bodies are securely clamped in place.
2. Verify that nailers are securely anchored to roof deck at terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of roof deck complies with requirements in Division 06.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation to achieve required thickness. Install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

H. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction. Loosely butt cover boards together and fasten to roof deck.

1. Fasten cover boards according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten cover boards to resist uplift pressure at corners, perimeter, and field of roof.

I. Install slip sheet over cover board and immediately beneath membrane roofing if required by membrane manufacturer.

3.4 ADHERED ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Fabric-Backed Roof Membrane Adhesive: Apply to substrate at rate required by manufacturer, and install fabric-backed roof membrane.

E. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. In-Seam Attachment: Secure one edge of PVC sheet using fastening plates or metal battens centered within membrane seam and mechanically fasten PVC sheet to roof deck.

H. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

I. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive per the manufacturer’s application instructions. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.6 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Final Roof Inspection: Upon completion of the Work and prior to final payment, the membrane manufacturer's representative, in the presence of the Owner and Architect, shall inspect Work. Discrepancies shall be recorded and immediately rectified. Final payment will not be issued until the manufacturer's representative has given his approval for Work and closeout submittals, including roof maintenance manual and warranties, have been received by the Architect.

1. Notify Architect or Owner 48 hours in advance of the date and time of inspection.

C. Verify field strength of seams a minimum of twice daily, according to manufacturer's written instructions, and repair seam sample areas.

D. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

E. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 PATCHING LIMITATIONS AND CLEANING REQUIREMENTS

A. Patching Restrictions: No more than 5 (in field) patches and no more than a total of 4 linear feet of seam patching per 100 sq. ft. of roof total square footage and no more than 5 patches and no seam patches

exceeding a total of 4 linear feet in any 100 sq. ft. roofing area as determined by Owner. Seam patches shall be minimum 8 inches wide and 24 inches long strip patch. Manufacturer required circular seam intersection patches shall not be considered when calculating number of patches. Typical patch size shall be minimum 6 inches square with rounded corners or as recommended by the membrane manufacturer. The use of large size patches (covering multiple penetrations) to avoid exceeding the limits set forth above will not be permitted. The use of large patches in excess of 24 by 36 inches shall be justification for replacement or for providing over lay membrane.

1. Any area in excess of patching limits set fort above shall be replaced with new membrane or overlaid with a new minimum 100 sq. ft un-patched membrane. Exact location and extent of new overlay membrane shall be determined by the Owner and membrane manufacturer's recommendations.

B. Cleaning: Provide daily cleaning to include, but not limited to, picking up and storing all lose items, sweeping clean roof surface, and removal and cleaning of all stains and spills prior to stopping of work for the day.

C. Substantial Completion Inspection and Cleaning: Roof surface shall be inspected for damage, trash and waste materials (fasteners and miscellaneous other construction items.) Remove all such items, and all spilled materials per manufacturer's removal instructions. Sweep clean and wash membrane to optimum cleanliness. Hand mop and hose clean (low pressure) with environmentally friendly (green) cleaners as recommended by roof membrane manufacturer. High pressure washers are not allowed. Final payment will not be made until this work has been completed and accepted.

D. Photographic Record: Upon completion of the roofing system the installer shall photo document the entire roof area to establish completion and condition. General Contractor shall assume responsibility for subsequent damage caused by construction operations carried out on/above completed roof system.

3.9 PROTECTING AND CLEANING

A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements; repair substrates; and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Provide daily cleaning to include but not limited to: Picking up and storing all lose items, sweeping clean roof surface and removal and cleaning of all stains and spills prior to stopping of work for the day.

D. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 075419

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Formed roof-drainage fabrications.
2. Formed low-slope sheet metal fabrications.
3. Formed wall sheet metal fabrications.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: For sheet metal flashing and trim. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of special conditions.
6. Details of connections to adjoining work.
7. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE CRITERIA

A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture,

fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

2.2 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat surface.

1. Exposed Coil-Coated Finish: Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color: As selected by Architect from manufacturer's full range.
3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer

1. Products: Subject to compliance with requirements, provide one of the following:

a. Atlas Roofing Corporation; WeatherMaster PolySeal.
b. Carlisle Coatings & Waterproofing Inc.; WIP 300HT.
c. CertainTeed Corporation; WinterGuard HT.
d. Drexel Metals Inc.; MetShield.
e. GAF Materials Corporation; Roof Pro.
f. GCP Applied Technologies; Grace Ice and Water Shield HT.
g. Henry Company; Blueskin PE200 HT.
h. InterWrap Inc.; Titanium PSU-30.
i. Kirsch Building Products, LLC; SharkSkin Ultra SA.
j. MFM Building Products Corp.; Ultra HT Wind and Water Seal.
k. Owens Corning; WeatherLock Specialty Tile & Metal.
l. Polyguard Products, Inc.; Deck Guard HT.
m. SPD Advanced Polymer Products, Inc.; Palisade-SA-HT.

2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F or higher.
3. Low-Temperature Flexibility: ASTM D1970; passes after testing at minus 20 degrees F.

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.

D. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true in line and levels indicated, with exposed edges folded back to form hems.

E. Seams: Fabricate nonmoving seams with flat-lock seams.

1. Tin edges to be seamed, form seams, and solder.
2. Coated Metals: Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Uncoated Aluminum: Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.
4. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

F. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

G. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

H. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual".

I. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

A. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch-wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.

1. Fabricate from 0.032 inch thick aluminum.

B. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes.

1. Fabricate from 0.032 inch thick aluminum.

C. Downspouts: Fabricate downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.

1. Style: Rectangular.
2. Fabricate from aluminum, 0.024 inch thick.
3. Finish: Two coat fluoropolymer.
4. Color: As selected by Architect from manufacturer's full range.

D. Splash Blocks: Precast concrete, steel-reinforced, 5000-psi minimum compressive strength, approximately 12 inches wide by 30 inches long, with 4-inch high curb on three sides. Provide chamfered corners and slope to drain.

1. Surface Appearance: Free of pockets, sand streaks, honeycombs, and other obvious defects. Corners shall be uniform, straight, and sharp.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Base Flashing: Fabricate from 0.040 inch thick aluminum.

B. Counterflashing: Refer to Section 077100 "Roof Specialties."

C. Flashing Receivers: Fabricate from 0.040 inch thick aluminum.

D. Roof-Penetration Flashing: Roofing membrane manufacturer’s approved system.

E. Roof-Drain Flashing: Roofing membrane manufacturer’s approved system.

2.8 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Refer to Section 042000 "Unit Masonry."

B. Opening Flashings in Frame Construction: Refer to Section 061600 "Sheathing" for flexible flashings.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Pipe Penetrations: Premolded rubber or roof membrane manufacturer’s recommended elastomeric type.

1. Provide stainless steel clamp ring, sealant, and fasteners as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to provide a complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
5. Torch cutting of sheet metal flashing and trim is not permitted.
6. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. Aluminum: Use aluminum or stainless-steel fasteners.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 – Joint Sealants.

G. Rivets: Rivet joints in uncoated aluminum where necessary for strength.

3.4 ROOF-DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

B. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal with elastomeric sealant to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Seal with elastomeric sealant exterior wall scupper flanges into back of conductor head.

C. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch below scupper discharge.

D. Downspouts:

1. Join sections with 1-1/2-inch telescoping joints.
2. Provide hangers with fasteners designed to hold downspouts securely to walls.
3. Locate hangers at top and bottom and at approximately 60 inches o.c.
4. Provide elbows at base of downspout to direct water away from building.

E. Splash Blocks: Install where downspouts discharge on lower roof or at grade.

3.5 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints minimum of 4 inches. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with butyl sealant and clamp flashing to pipes that penetrate roof.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Section 042000 "Unit Masonry."

C. Opening Flashings in Frame Construction: Install flexible flashings in accordance with 061600 "Sheathing."

3.7 MISCELLANEOUS FLASHING INSTALLATION

A. Pipe Penetration Flashing: Install in accordance with roofing membrane manufacturer's written instructions.

3.8 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.9 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Copings.
2. Reglets and counterflashings.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. Except as otherwise shown on Drawings or specified, the workmanship of sheet metal work, method for forming joints, anchoring, cleating and provisions for expansion shall conform to the standard details and recommendations of the Copper and Brass Research Association; and workmanship shall be of the best quality, in accordance with best trade practice and the recommendations and specifications of the Sheet Metal and Air Conditioning Contractors National Association, Inc.

C. FM Approvals' Listing: Manufacture and install copings and roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

D. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1 and capable of resisting the following design pressures:

1. Design Pressure: As indicated on Drawings.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

C. Samples: For each type of roof specialty indicated with factory-applied color finishes.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

B. Warranty: Sample of special warranty.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, approximately 10 feet long, including supporting construction, seams, attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details and condition of other construction that will affect roof specialties.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with copings and roof-edge flashings by field measurements before fabrication.

1.9 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

    a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXPOSED METALS

A. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper to suit forming operations and performance required.

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finishes: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Two-Coat Fluoropolymer: AAMA 620. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

2.2 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.

C. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 COPINGS

A. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.

1. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

    a. ATAS International, Inc.
    b. Hickman Company, W. P.
    c. Merchant & Evans, Inc.
    d. Metal-Era, Inc.
    e. Metal Roofing Systems
    f. MM Systems Corporation
    g. Petersen Aluminum Corporation

2. Coping-Cap Material: Formed aluminum, 0.050-inch-thick; or thickness as required to meet performance requirements.
3. Corners: Factory mitered and continuously welded.
4. Coping-Cap Attachment Method: Snap-on, fabricated from coping-cap material.

    a. Snap-on-Coping Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.

5. Color: Color as selected by Architect from manufacturer's full range.

2.5 REGLETS AND COUNTERFLASHINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fry Reglet Corporation.
2. Hickman Company, W. P.
3. Metal-Era, Inc.
4. MM Systems Corporation.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Material: Aluminum, 0.040 inch thick.
2. Corners: Factory mitered and continuously welded.
3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.
5. Color: As selected by Architect from manufacturer's full range.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:

1. Formed Aluminum: 0.040 inch thick.
2. Color: As selected by Architect from manufacturer's full range.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer and as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.3 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to meet performance requirements.

1. Interlock face leg and back leg drip edges on snap-on coping cap into cleated anchored plates anchored to substrate at manufacturer's required spacing that meets performance requirements.

3.4 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Surface-Mounted Reglets: Install reglets to receive flashings where indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

C. Embedded Reglets: See Section 042000 "Unit Masonry" for installation of reglets.

D. Counterflashings: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashings into reglets or other indicated receivers and fit tightly to base flashing. Extend counterflashings 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

3.5 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 078100 - APPLIED FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes sprayed fire-resistive materials.

1.3 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Material List: Provide an inclusive list of required fireproofing materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying fireproofing materials.

B. Shop Drawings: Structural framing plans indicating the following:

1. Locations and types of surface preparations required before applying fireproofing.
2. Extent of fireproofing for each construction and fire-resistance rating, including the following:
    a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
        1) For steel joist assemblies, include applicable fire-resistance design designations, with each steel joist tested with the same maximum tensile stress as each steel joist indicated on Drawings. Design designations with steel joists tested at lower maximum tensile stress than those indicated are not permitted.
    b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.
3. Treatment of fireproofing after application.

1.6 INFORMATIONAL SUBMITTALS

A. Calculations: Provide W/D calculations and a schedule of fireproofing thicknesses required for each beam size scheduled.

B. Product certificates.

C. Qualification Data: For Installer.

D. Compatibility and Adhesion Test Reports: From fireproofing manufacturer indicating the following:

1. Materials have been tested for bond with substrates.
2. Materials have been verified by fireproofing manufacturer to be compatible with substrate primers and coatings.
3. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Field quality-control test and special inspection reports.

F. Warranties: Special warranties specified in this Section.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

B. Fireproofing Testing: By a qualified testing and inspecting agency engaged by Owner to test for compliance with specified requirements for performance and test methods.

1. Fireproofing materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Testing is performed on specimens of fireproofing that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.

C. Compatibility and Adhesion Testing: Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.

1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with fireproofing materials.

D. Fire-Test-Response Characteristics: Provide fireproofing with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify bags containing fireproofing with appropriate markings of applicable testing and inspecting agency.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency acceptable to authorities having jurisdiction, for SFRM serving as direct-applied protection tested per ASTM E 119.
2. Surface-Burning Characteristics: Comply with ASTM E 84.

E. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."

F. Manufacturer's Technical Representative: A manufacturer's representative/fire protection specialist shall be on-site during application of mock-up and start-up of fireproofing installation.

G. Mockups: For fireproofing, apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Extent of Mockups: Approximately 100 sq. ft. of surface for each product indicated.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Final Acceptance.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to fireproofing including, but not limited to, the following:

1. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.
2. Review and finalize construction schedule and verify sequencing and coordination requirements.
3. Review weather predictions, ambient conditions, and proposed temporary protections for fireproofing during and after installation.
4. Review surface conditions and preparations.
5. Review field quality-control testing procedures.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer’s written instructions for delivery, storage and handling of fireproofing materials. Protect fireproofing materials from freezing.

B. Deliver products to Project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, shelf life if applicable, and fire-resistance ratings applicable to Project.

C. Use materials with limited shelf life within period indicated. Remove from Project site and discard materials whose shelf life has expired.

D. Store materials inside, under cover, and aboveground; keep dry until ready for use. Remove from Project site and discard wet or deteriorated materials.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing material dries thoroughly.

1.10 COORDINATION

A. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing. As installation of other construction proceeds, inspect fireproofing and patch any damaged or removed areas.

B. Sequence and coordinate application of fireproofing with other related work specified in other Sections to comply with the following requirements:

1. Provide temporary enclosure as required to confine spraying operations and protect the environment.
2. Provide temporary enclosures for applications to prevent deterioration of fireproofing material due to exposure to weather and to unfavorable ambient conditions for humidity, temperature, and ventilation.
3. Avoid unnecessary exposure of fireproofing material to abrasion and other damage likely to occur during construction operations subsequent to its application.
4. Do not apply fireproofing material to metal roof deck substrates until concrete topping, if any, has been completed. For metal roof decks without concrete topping, do not apply fireproofing material to metal roof deck substrates until roofing has been completed; prohibit roof traffic during application and drying of fireproofing material.
5. Do not apply fireproofing material to metal floor deck substrates until concrete topping has been completed.
6. Do not begin applying fireproofing material until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
7. Defer installing ducts, piping, and other items that would interfere with applying fireproofing material until application of fire protection is completed.
8. Do not install enclosing or concealing construction until after fireproofing material has been applied, inspected, and tested and corrections have been made to defective applications.

C. Coordination of Work: Review other Sections of these Specifications in which primers are provided to ensure compatibility of the total fireproofing system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using coatings specified over substrates primed by others.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form signed by Contractor and by Installer, in which manufacturer agrees to repair or replace fireproofings that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Cracking, flaking, spalling, or eroding in excess of specified requirements; peeling; or delaminating of fireproofing from substrates.
b. Not covered under the warranty are failures due to damage by occupants and Owner's maintenance personnel, exposure to environmental conditions other than those investigated and approved during fire-response testing, and other causes not reasonably foreseeable under conditions of normal use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.

B. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. Asbestos: Provide products containing no detectable asbestos.

D. Calculation Requirements:

1. For steel beams complying with UL Designs indicated on Drawings and W/D values required by North Carolina Building Code, Contractor shall provide fireproofing thickness as required by UL Design.
2. For steel beams not complying with UL Design indicated on Drawings and W/D values required by North Carolina Building Code, Contractor is responsible to have the W/D ratio, weight-to-heated-perimeter, calculated and provide fireproofing thickness as required to meet UL Designs and North Carolina Building Code.

a. Refer to NCBC, Section 721.5.2.2.

3. Unless specifically noted otherwise, the steel structure shall be considered "unrestrained" in accordance with the fire exposure and acceptance criteria specified in ASTM E 119 for the purpose of determining the thickness of spray-applied fireproofing.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carboline Company; a subsidiary of RPM International.
b. GCP Applied Technologies Inc.
c. Isolatek International.
d. Pyrok, Inc.
e. Schundler Company (The).
f. Southwest Fireproofing Products Co.

2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Bond Strength: Minimum 150-lbf/sq. ft. cohesive and adhesive strength based on field testing according to ASTM E736.
4. Density: Not less than 15 lb/cu.ft. and as specified in the approved fire-resistance design, according to ASTM E 605.
5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E605, whichever is thicker, but not less than 0.375 inch.
6. Combustion Characteristics: ASTM E136.
7. Surface-Burning Characteristics: Comply with ASTM E84.

a. Flame-Spread Index: 10 or less.

b. Smoke-Developed Index: 10 or less.

8. Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 1,440 psf.
9. Corrosion Resistance: No evidence of corrosion according to ASTM E937.
10. Deflection: No cracking, spalling, or delamination according to ASTM E759.
11. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E760.
12. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours according to ASTM E859.
13. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21 or rating of 10 according to ASTM D3274 when tested according to ASTM D3273.
14. Finish: Manufacturer's standard finish for concealed application.

2.3 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by fireproofing manufacturer for the required fire-resistance design.

C. Bonding Agent: Product approved by fireproofing manufacturer.

D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required to comply with fire-resistance designs indicated and fireproofing material manufacturer's written recommendations. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.

E. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

F. Reinforcing Fabric: Glass- or carbon-fiber fabric reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer.

G. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of work. A substrate is in satisfactory condition if it complies with the following:

1. Substrates comply with requirements in the Section where the substrate and related materials and construction are specified.
2. Substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, incompatible paints, incompatible encapsulants, or other foreign substances capable of impairing bond of fireproofing materials with substrates under conditions of normal use or fire exposure.
3. Objects penetrating fireproofing material, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.

4. Substrates are not obstructed by ducts, piping, equipment, and other suspended construction that will interfere with applying fireproofing material.

B. Verify that concrete work on steel deck has been completed.

C. Verify that roof construction, installation of roof-top HVAC equipment, and other related work are completed.

D. Conduct tests according to fireproofing material manufacturer's written recommendations to verify that substrates are free of substances capable of interfering with bond.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Examine substrates, areas, and conditions, with the Applicator present, under which fireproofing application will be performed for compliance with requirements and conditions affecting coating performance.

1. Proceed with fireproofing application only after unsatisfactory conditions have been corrected and surfaces receiving coating are thoroughly dry.
2. Start of coating will be construed as the Applicator's approval of surfaces and conditions within a particular area.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.

B. Clean substrates of substances that could impair bond of fireproofing material, including dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, and incompatible primers, paints, and encapsulants.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

D. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

E. For exposed applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fireproofing products after application.

3.3 APPLICATION

A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.

B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.

D. Metal Decks:

1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, has been completed.
2. Do not apply fireproofing to underside of metal roof deck until roofing has been completed; prohibit construction roof traffic during, or after the application of fireproofing.

E. Install metal lath, as required, to comply with fire-resistance ratings and fireproofing material manufacturer's written recommendations for conditions of exposure and intended use. Securely attach lath to substrate in position required for support and reinforcement of fireproofing material. For auxiliary materials, use anchorage devices of type recommended in writing by fireproofing manufacturer. Attach accessories where indicated or required for secure attachment of lath to substrate.

F. Coat substrates with bonding adhesive before applying fireproofing material where required to achieve fire-resistance rating or as recommended in writing by fireproofing manufacturer for material and application indicated.

G. Extend fireproofing material in full thickness over entire area of each substrate to be protected. Unless otherwise recommended in writing by fireproofing manufacturer, install body of fireproofing covering in a single course.

H. Spray apply fireproofing materials to maximum extent possible. Following the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.

I. Apply SFRM in thicknesses and densities not less than those required to achieve unrestrained fire-resistance ratings designated for each condition, but apply in greater thicknesses and densities if indicated.

J. Provide a uniform finish complying with description indicated for each type of material and matching Architect's sample or, if none, finish approved for field-erected mockup.

K. Cure SFRM according to product manufacturer's written recommendations.

L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspection and prepare reports for fireproofing.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

C. Tests and Inspections: Testing and inspecting of completed applications of fireproofing shall take place in successive stages, in areas of extent and using methods as follows. Do not proceed with application of

fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values indicated and required for approved fire-resistance design.

1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials."

D. Remove and replace applications of fireproofing that do not pass tests and inspections for cohesion and adhesion, for density, or for both and retest as specified above.

E. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate that thickness does not comply with specified requirements, and retest as specified above.

3.5 CLEANING, PROTECTING, AND REPAIRING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

B. Repair fireproofing damaged by other work before concealing it with other construction.

C. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100

SECTION 078200 - BOARD FIREPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Mineral-fiber board fire protection.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Locations and types of surface preparations required before applying board fire protection.
2. Structural framing plan showing extent of board fire protection for each construction and fire-resistance rating, including the following:

a. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.

1) For steel joist assemblies, include applicable fire-resistance design designations, with each steel joist tested with same maximum tensile stress as each steel joist indicated on Drawings. Design designations with steel joists tested at lower maximum tensile stress than those indicated are not permitted.

b. Minimum thicknesses needed to achieve required fire-resistance ratings of structural components and assemblies.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of board fire protection.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" for board fire protection serving as direct-applied protection tested according to ASTM E119.

2.2 BOARD FIRE PROTECTION

A. Mineral-Fiber Board: Foil-faced rigid board produced by combining slag-wool-/rock-wool fibers with thermosetting resin binders passing ASTM E136 for combustion characteristics; of thickness required to produce fire-resistance rating indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Albi Manufacturing; a division of StanChem, Inc.
b. Isolatek International.
c. Rockwool International.

2. Maximum Density: 9 lb/cu. ft.
3. Surface-Burning Characteristics: Flame-spread and smoke-developed indexes of 15 and 5, respectively, according to ASTM E84.
4. Foil-Face Color: White.

2.3 ACCESSORIES

A. Anchorage Accessories: Provide manufacturer's standard board-anchorage components complying with related design of UL or of another testing and inspecting agency acceptable to authorities having jurisdiction.

B. Joint Treatment and Finishing Materials: Provide joint treatment tape and joint compounds recommended in writing by board manufacturer for finishing surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install board fire protection on structural members after piping and other construction behind fire-resistive materials have been completed.

B. Welded-Stud Systems: Remove rust and scale from steel substrates at welded-steel-stud anchorage locations.

3.2 INSTALLATION

A. Install board fire protection according to manufacturer's written instructions.

B. Install board fire protection to comply with requirements for layer thicknesses and number, construction of joints and corners, and anchorage methods applicable to fire-resistance-rated assemblies indicated.

C. Install enclosing or concealing construction only after board fire protection has been applied and inspected by authorities having jurisdiction

3.3 PROTECTION

A. Replace or repair board fire protection that has been cut away to facilitate other construction. Maintain complete coverage of full thickness on members and substrates protected by board fire protection.

1. Provide final protection and maintain conditions in a manner acceptable to Installer, manufacturer, and authorities having jurisdiction to ensure that board fire protection is without damage or deterioration at time of Substantial Completion.

END OF SECTION 078200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through the following fire-resistance-rated assemblies, including both empty openings and openings containing penetrating items:

1. Floors.
2. Roofs.
3. Walls and partitions.

B. Related Sections:

1. Section 078446 "Fire-Resistive Joint Systems" for joints in or between fire-resistance-rated construction and in smoke barriers.

1.3 PERFORMANCE REQUIREMENTS

A. General: For the following constructions, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly penetrated.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.
4. Fire-resistance-rated roof assemblies.
5. Smoke barriers.

B. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

1. Penetrations located outside wall cavities.
2. Penetrations located outside fire-resistive shaft enclosures.
3. Penetrations located in construction containing fire-protection-rated openings.
4. Penetrating items larger than 4-inch- diameter nominal pipe or 16 sq. in. in overall cross-sectional area.

D. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that after curing do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

E. For through-penetration firestop systems exposed to view, provide products with flame-spread ratings of less than 25 and smoke-developed ratings of less than 450, as determined per ASTM E 84.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of through-penetration firestop system product indicated.

B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer.
    a. Engineer shall be legally qualified to practice in the state in which the project is located.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.

C. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain through-penetration firestop systems from a single manufacturer.

B. Installer's Qualifications: An experienced installer who is qualified by having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Firm shall hold current certification by third party attesting to its ability to select and install firestopping in accordance with performance requirements, have established management system for firestopping and employ trained supervisor (DRI) to maintain oversight of firestopping installation.

1. Certification for firestopping firms: Firm shall be certified by one of the following:
    a. Factory Mutual Global: FM Standard 4991.

b. UL Qualified Firestop Contractor.

2. Qualification for Superintendent: Superintendent shall have a minimum of 3 years experience in firestopping.
3. Qualification for Firestop Installer: Trained individual in accordance with requirements of certification of firm.

   a. Firestop Installers Training (FIT) Level 1 by Specified Technologies, Inc.
   b. Certified 3M Trained by 3M Fire Protection Products.
   c. Hilti Basic Firestop Training
   d. Similar training by manufacturers listed in Part 2.

4. A manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to an installer engaged by Contractor does not in itself confer qualification on buyer.

C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems complying with the following requirements:

   a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
   b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

      1) UL in "Fire Resistance Directory."

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1.

1. Before installation of fire-resistance-rated assemblies and penetrating items, review through-penetration firestop system and examine procedures for ensuring quality of installed systems. Require representatives of each entity directly concerned with through-penetration firestop system to attend, including the following:

   a. Contractor's superintendent.
   b. Independent testing agency responsible for through-penetration firestop system.
   c. Through-penetration firestop system Manufacturer’s service representative.
   d. Through-penetration firestop system Installer.
   e. Fire- resistance-rated masonry Installer.
   f. Fire- resistance-rated gypsum board assembly Installer.
   g. Mechanical piping Installer.
   h. HVAC ductwork Installer.
   i. Electrical wireway Installer.

2. Review inspection and testing and inspecting agency procedures for field quality control, through-penetration firestop system installation, and coordination of penetrating item configurations with available rated through-penetration firestop system assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti Construction Chemicals, Inc.
2. Specified Technologies Inc.
3. 3M Fire Protection Products.
4. Tremco.

2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

2.3 PENETRATION FIRESTOPPING

A. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Fire-resistance-rated walls include fire walls, fire-barrier walls, and fire partitions.
2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

B. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.

1. Horizontal assemblies include floors, floor/ceiling assemblies and ceiling membranes of roof/ceiling assemblies.
2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

C. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.

1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.

D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by the qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:

1. Permanent forming/damming/backing materials, including the following:
    a. Slag-/rock-wool-fiber insulation.
    b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with "Performance Requirements" Article and firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect through-penetration firestop systems in accordance with ASTM E 2174 and to prepare test reports.

1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with or deviate from requirements.

B. Compliance Inspections: One week prior to inspections by authorities having jurisdiction, Manufacturer's Representative shall perform compliance inspection with General Contractor's designated representative

present. Reports shall be provided to General Contractor, with a copy to the Owner, Architect, and Firestopping Installer.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued.

D. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5 IDENTIFICATION

A. Penetration Identification: Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:

1. The words: "Warning--Through-Penetration Firestop System--Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

B. Wall Identification: Refer to Section 099123 "Interior Painting" for identification of fire-rated walls and smoke barriers.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

END OF SECTION 078413

SECTION 078446 - FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes fire-resistive joint systems for the following:

1. Floor-to-floor joints.
2. Floor-to-wall joints.
3. Head-of-wall joints.
4. Wall-to-wall joints.
5. Joints in smoke barriers.

B. Related Sections include the following:

1. Section 072100 "Thermal Insulation" for closed-cell spray polyurethane foam insulation used as head-of-wall sealant for non-rated walls.
2. Section 078413 "Penetration Firestopping" for systems installed in openings in walls and floors with and without penetrating items.
3. Section 079200 "Joint Sealants" for non-fire-resistive joint sealants.

1.3 PERFORMANCE REQUIREMENTS

A. General: For joints in the following constructions, provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which fire-resistive joint systems are installed. Fire-resistive joint systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.

1. Fire-resistance-rated load-bearing walls, including partitions, with fire-protection-rated openings.
2. Fire-resistance-rated non-load-bearing walls, including partitions, with fire-protection-rated openings.
3. Fire-resistance-rated floor assemblies.
4. Smoke barriers.

B. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire-resistance rating of constructions in which joints are located, as determined by UL 2079.

1. Load-bearing capabilities as determined by evaluation during the time test.

C. Fire Resistance of Perimeter Fire-Containment Systems: Integrity and insulation ratings indicated as determined by UL 2079.

D. Exposed Fire-Resistive Joint Systems: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each fire-resistive joint system, show relationships to adjoining construction. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

C. Product Schedule: For each fire-resistive joint system. Include location and design designation of qualified testing agency.

1. Where Project conditions require modification to a qualified testing agency's illustration for a particular fire-resistive joint system condition, submit illustration, with modifications marked, approved by fire-resistive joint system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

B. Installer Certificates: From Installer indicating fire-resistive joint systems have been installed in compliance with requirements and manufacturer's written recommendations.

C. Qualification Data: For Installer.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Comply with requirements of Section 078413 "Penetration Firestopping."

B. Source Limitations: Obtain fire-resistive joint systems for each kind of joint and construction condition indicated through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in "Performance Requirements" Article:

1. Fire-resistive joint systems are identical to those tested per UL 2079**.** Perimeter fire-containment systems are identical to those tested per both UBC Standard 26-9 and UL 2079. Provide rated systems complying with the following requirements:

a. Fire-resistive joint systems correspond to those indicated by referencing system designations listed by the following:

1) UL in its "Fire Resistance Directory."
2) Intertek ETL SEMKO in its "Directory of Listed Building Products."

D. Preinstallation Conference: Refer to requirements of Section 078413 "Penetration Firestop Systems."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver fire-resistive joint system products to Project site in original, unopened containers or packages with qualified testing and inspecting agency's classification marking applicable to Project and with intact

and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for fire-resistive joint systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not install fire-resistive joint systems when ambient or substrate temperatures are outside limits permitted by fire-resistive joint system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate fire-resistive joint systems per manufacturer's written instructions by natural means or, if this is inadequate, forced-air circulation.

1.9 COORDINATION

A. Coordinate construction of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

B. Coordinate sizing of joints to accommodate fire-resistive joint systems.

C. Notify Owner's inspecting agency at least seven days in advance of fire-resistive joint system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up fire-resistive joint system installations that will become concealed behind other construction until Owner's inspecting agency and building inspector, if required by authorities having jurisdiction, have examined each installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti Construction Chemicals, Inc.
2. Specified Technologies Inc.
3. 3M Fire Protection Products.
4. Tremco.

2.2 FIRE-RESISTIVE JOINT SYSTEMS, GENERAL

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

2.3 PERIMETER FIRE-CONTAINMENT SYSTEMS

A. Joints in or between Fire-Resistance-Rated Construction: Provide fire-resistive joint systems with ratings determined per ASTM E 1966 or UL 2079:

1. Joints include those installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies.
2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of construction they will join.

B. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079.

1. L-Rating: Not exceeding 5.0 cfm/ft of joint at 0.30 inch wg at both ambient and elevated temperatures.

2.4 HEAD OF WALL SEALING

A. Head of Wall Sealing: Comply with requirements of UL HW-D-0020 or equivalent design.

1. Contractor's Option: Spray or sealant products may be used.

a. 3M; FireDam Spray or FD 150+ Sealant
b. GCP Applied Technologies; FlameSafe 3000 Spray or FS 900 Sealant
c. Hilti; CP672 Firestop Spray or CP 606 Sealant

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:

1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.
2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates.

3.3 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify fire-resistive joint systems with preprinted metal or plastic labels or self-adhesive vinyl labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels will be visible to anyone seeking to remove or penetrate joint system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Fire-Resistive Joint System - Do Not Disturb. Notify Building Management of Any Damage."

3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect fire-resistive joint systems according to ASTM E 2393 and to prepare inspection reports.

1. Inspecting agency will state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

B. Compliance Inspections: One week prior to inspections by authorities having jurisdiction, Manufacturer's Representative shall perform compliance inspection with General Contractor's designated representative present. Reports shall be provided to General Contractor, with a copy to the Owner, Architect, and Firestopping Installer.

C. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and inspecting agency has approved installed fire-resistive joint systems.

D. If deficiencies are found, repair or replace fire-resistive joint systems so they comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to joints as Work progresses by methods and with cleaning materials that are approved in writing by fire-resistive joint system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure fire-resistive joint systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 078446

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
2. Exterior joints in horizontal traffic surfaces.
3. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
4. Interior joints in horizontal traffic surfaces.

B. Related Sections include the following:

1. Section 042000 "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
2. Section 078446 "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction and for head-of-wall sealants.
3. Section 088000 "Glazing" for glazing sealants.

1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants and joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 Articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range of available colors including premium colors.

1. Where color is indicated to “match adjacent substrates” provide either manufacturer’s standard color if matching color is available, or, if not available, provide field tintable custom color.

2.3 SILICONE JOINT SEALANTS

A. Silicone Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Single Component, Nonsag, Neutral-Curing Silicone Sealant:

1. Products:

a. Dow Corning Corporation; 790
b. GE Momentive SilPruf LM SCS2700
c. Pecora Corporation; 890
d. Sika Corporation; 290
e. Tremco Incorporated; Spectrem 1

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M (Masonry), G (Glass), A (Aluminum), and, as applicable to joint substrates indicated, O (Other).
6. Non-staining for natural stone substrates.
7. Field-tintable to match adjacent substrates.
8. Exterior Joint Locations:

a. Cast-in-place concrete, vertical construction joints,
b. Unit masonry, vertical control and expansion joints,
c. Metal panels,
d. Exterior vertical joints between different materials listed above,

e. Exterior perimeter joints between materials listed above and frames of doors, windows, and louvers,
f. Exterior control and expansion joints in ceilings and other overhead surfaces,
g. Other vertical or horizontal non-traffic joints.

9. Interior Joint Locations:

a. Vertical control and expansion joints on exposed interior surfaces of exterior walls,
b. Interior perimeter joints of exterior openings.

C. Single-Component, Traffic Exposure, Neutral-Curing Silicone Sealant: Complying with FAA P-605.

1. Products:

a. Dow Corning Corporation; 890-SL
b. Pecora Corporation; 300 SL
c. Sika Corporation; 728 SL
d. Tremco Incorporated; Spectrem 900 SL

2. Type and Grade: S (single component) and P (pourable).
3. Class: 100/50.
4. Uses Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and O, as applicable to joint substrates indicated.
6. Exterior Joint Locations:

a. Cast-in-place concrete slabs, horizontal nontraffic and traffic isolation and contraction joints,
b. Other exterior horizontal traffic joints.

7. Interior Joint Locations:

a. Interior ceramic and dimension stone tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.

D. Single-Component, Mildew-Resistant, Neutral-Curing Silicone Sealant:

1. Products:

a. Dow Corning Corporation; 786
b. Pecora Corporation; 898
c. Sika Corporation; SikaSil N
d. Tremco; Tremsil 600 White

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
6. Interior Joint Locations:

a. Interior tile expansion, control, contraction, and isolation joints in vertical surfaces.
b. Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Bostik; Chem-Calk 300
b. Pecora; BC-158
c. Tremco; General Purpose Butyl Sealant

2. Exterior Joint Locations: Under door thresholds.

2.6 LATEX JOINT SEALANTS

A. Latex Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products:

a. BASF Building Systems; Sonolac
b. Bostik, Inc.; Chem-Calk 600
c. Pecora Corporation; AC-20+
d. Tremco Incorporated; Tremflex 834

2. Interior Joint Locations:

a. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances,

1) Color: Paintable white.

b. Other non-dynamic interior joints including between interior wall surfaces and casework.

1) Color: Clear.

2.7 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Building Systems
b. Hilti
c. Pecora Corporation
d. Tremco

2. Interior Joint Locations: Acoustical interior joints for concealed and exposed joints.

2.8 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), or B (bicellular material with a surface skin), as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Consult the sealant manufacturer to confirm the specific backer material to be used for the specific project and application, and submit to Architect the manufacturer's written recommendations.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.9 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type recommended by manufacturer to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Installation of Preformed Foam Sealants: Install secondary seal at depth sufficient to allow installation of properly sized backer rod and liquid sealant in front of secondary seal. Comply with manufacturer's written instructions.

1. Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

H. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or

damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes hollow-metal work.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.

C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld International, LLC.
2. Ceco Door; ASSA ABLOY.
3. Curries Company; ASSA ABLOY.
4. Fleming Door Products Ltd.; Assa Abloy Group Company.
5. Pioneer Industries.
6. Republic Doors and Frames.
7. Steelcraft; an Allegion brand.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches
    c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
    d. Edge Construction: Model 2, Seamless.
    e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
3. Frames:
    a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A60 coating.
    b. Construction: Full profile welded.
4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A60 (galvannealed) metallic coating.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

G. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke- developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

J. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.6 STOPS AND MOLDINGS

A. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

B. Moldings for Glazed Lites in Doors: Minimum 0.032-inch-thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

D. Loose/Removable Stops for Glazed Lites in Frames: Minimum 0.032-inch-thick, fabricated from same material as frames in which they are installed.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.8 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
2. Fire Door Cores: As required to provide fire-protection ratings indicated.
3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
7. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.

4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
5. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    c. Compression Type: Not less than two anchors in each frame.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
6. Head Anchors: Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow- metal work.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of hollow-metal work.
5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.9 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM- HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

    a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
    c. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
    d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow- metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer according to manufacturer's written instructions.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Verification: Factory finishes applied to actual door face materials, approximately 12 by 12 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors from single manufacturer.

B. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards and WDMA I.S.1-A, "Architectural Wood Flush Doors."

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252.

D. Preinstallation Conference: Conduct conference at Project site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eggers Industries
2. Graham; an Assa Abloy Group company
3. Lambton Doors
4. Marshfield Door Systems, Inc.
5. Mohawk Flush Doors, Inc.; a Masonite company
6. Oshkosh Architectural Door Company
7. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2, made with binder containing no urea-formaldehyde resin.
2. Blocking: Provide wood blocking in particleboard-core doors as follows:

a. 5-inch top-rail blocking, in doors indicated to have closers.
b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

B. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf.
b. Screw Withdrawal, Edge: 400 lbf.

C. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:

a. 5-inch top-rail blocking.
b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch midrail blocking, in doors indicated to have armor plates.
d. 5-inch midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors **(DS-1)**:

1. Grade: Custom (Grade A faces).
2. Species and Cut: Match existing.
3. Match between Veneer Leaves: Match existing.
4. Assembly of Veneer Leaves on Door Faces: Match existing.
5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
6. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.
7. Exposed Vertical and Top Edges: Same species as faces.
8. Core: Particleboard, unless otherwise indicated.
9. Construction: Seven plies, hot-pressed, bonded or unbonded.
10. WDMA I.S.1-A Performance Grade: Heavy Duty.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Finish top of doors in multi-story spaces. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises, unless noted otherwise.

B. Transparent Finish:

1. Grade: Custom.
2. Finish: AWI conversion varnish or catalyzed polyurethane system.
3. Staining: Match Architect's sample.
4. Effect: Filled finish.
5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

C. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.4 INFORMATIONAL SUBMITTALS

A. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.5 QUALITY ASSURANCE

A. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.6 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Where required, provide assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated or cold-rolled steel sheet substrate complying with ASTM A 1008/ A 1008M, Commercial Steel (CS), exposed.

2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Flush Access Doors and Frames with Exposed Trim: Fabricated from steel sheet.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acudor Products, Inc.
b. Babcock-Davis
c. J. L. Industries, Inc.
d. Karp Associates, Inc.
e. Larsen's Manufacturing Company
f. MIFAB, Inc.
g. Milcor Inc.
h. Nystrom, Inc.
i. Williams Bros. Corporation of America (The)

2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Wall and ceiling surfaces.
4. Door: Minimum 0.060-inch thick sheet metal, set flush with exposed face flange of frame, factory primed.
5. Frame: Minimum 0.060-inch thick sheet metal with 1-inch- wide, surface-mounted trim, factory primed.
6. Hinges: Continuous piano.
7. Latch: Cam latch operated by screwdriver with interior release.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal framing.
3. Provide mounting holes in frame for attachment of masonry anchors. Furnish adjustable metal masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

2.5 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

3.3 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulated service doors.
2. Fire-rated, insulated service doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capabilities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls and other accessories.
6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, section 5.2.3.1.
2. Submit copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.5 CLOSEOUT SUBMITTALS

A. Special warranty.

B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

C. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Fire-Rated Door Inspector Qualifications: Inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Complying with NFPA 80; listed and labeled by qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.

1. Smoke Control: In corridors and smoke barriers, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. of door opening at 0.10 inch wg for both ambient and elevated temperature tests.

B. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

C. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:

1. Design Wind Load: As indicated on Drawings.
2. Testing: According to ASTM E330/E330M.
3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.

2.3 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Alpine Overhead Doors, Inc.
    b. C.H.I. Overhead Doors, Inc.
    c. Cookson Company
    d. Cornell
    e. McKeon Rolling Steel Door Company, Inc.
    f. Overhead Door Corporation

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Curtain R-Value: 5.0 deg F x h x sq. ft./Btu.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 3-1/4-inch center-to-center height.

1. Insulated-Slat Interior Facing: Metal.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

F. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from steel and finished to match door.

G. Curtain Jamb Guides: Steel with exposed finish matching curtain slats.

H. Hood: Match curtain material and finish.

1. Shape: Manufacturer's standard.
2. Mounting: Face of wall, unless otherwise indicated on Drawings.

I. Electric Door Operator:

1. Usage Classification: Heavy duty, 50 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
4. Motor Exposure: Interior.
5. Motor Electrical Characteristics:

    a. Voltage: 120-V ac, single phase, 60 Hz.

6. Emergency Manual Operation: Chain type.
7. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar; self-monitoring type.

J. Curtain Accessories: Equip door with weatherseals.

K. Door Finish:

1. Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 FIRE-RATED DOOR ASSEMBLY

A. Fire-Rated, Insulated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Alpine Overhead Doors, Inc.
b. C.H.I. Overhead Doors, Inc.
c. Cookson Company
d. Cornell
e. McKeon Rolling Steel Door Company, Inc.
f. Overhead Door Corporation

B. Operation Cycles: Door components and operators capable of operating for not less than 25,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

1. Include tamperproof cycle counter.

C. Fire Rating: As indicated on Drawings.

D. Curtain R-Value: 5.0 deg F x h x sq. ft./Btu.

E. Door Curtain Material: Galvanized steel.

F. Door Curtain Slats: Flat profile slats of 3-1/4-inch center-to-center height.

1. Insulated-Slat Interior Facing: Metal.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from steel and finished to match door.

H. Curtain Jamb Guides: Steel with exposed finish matching curtain slats.

I. Hood: Match curtain material and finish.

1. Shape: Manufacturer's standard.
2. Mounting: Face of wall, unless otherwise indicated on Drawings.

J. Electric Door Operator:

1. Usage Classification: Heavy duty, 50 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use.
4. Motor Exposure: Interior.
5. Motor Electrical Characteristics:

a. Voltage: 120-V ac, single phase, 60 Hz.

6. Emergency Manual Operation: Chain type.
7. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar; self-monitoring type.

K. Curtain Accessories: Equip door with weatherseals.

L. Door Finish:

1. Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.5 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch and as required to meet requirements.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum aluminum thickness of 0.032 inch.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.7 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.

2.8 CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene.

2.9 COUNTERBALANCE MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel

connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.

1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.

1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Provide a wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator.

G. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation.

1. Chain-Hoist Operator: Consisting of endless steel hand chain, chain-pocket wheel and guard, and gear-reduction unit with a maximum 25-lbf force for door operation. Provide alloy-steel hand chain with chain holder secured to operator guide.

H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 GALVANIZED STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

D. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

1. Adjust exterior doors and components to be weather resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Exterior and interior storefront framing.
2. Exterior and interior manual-swing entrance doors and door-frame units.

B. Products installed, but not furnished, under this Section include the following:

1. Door hardware furnished under Section 087100 "Door Hardware."

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:

    a. Deflection exceeding specified limits.
    b. Thermal stresses transferring to building structure.
    c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
    d. Noise or vibration created by wind and by thermal and structural movements.
    e. Loosening or weakening of fasteners, attachments, and other components.
    f. Sealant failure.
    g. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1. Professional engineer shall be legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated.

C. Wind Loads: As indicated on Structural Drawings.

D. Deflection of Framing Members:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components directly below them to less than 1/8 inch and clearance between members and operable units directly below them to less than 1/16 inch.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:

1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

F. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Structural Drawings.
2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.

G. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.

H. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

I. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft.

1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

J. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

K. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC- certified condensation resistance rating of no less than 50 as determined according to NFRC 500.

L. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.45 Btu/sq. ft. x h x deg F when tested according to AAMA 1503.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
2. Show sill pan.
3. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.

C. Samples for Verification:

1. For each type of exposed finish required, in manufacturer's standard sizes.
2. Sill Pan: Full-size factory fabricated unit.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12-inch lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

E. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of aluminum-framed systems.
2. Detail anchorage system to substrate.
3. Include design calculations.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Thermal Conductance Certificates: Provide project-specific certificates for glazed aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

1. Basis for Certification: AAMA-certified thermal conductance values for each glazed aluminum-framed entrance and storefront.

C. Welding certificates.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

E. Field quality-control reports.

F. Warranties: Sample of special warranties.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Provide entrances and storefront produced by a single manufacturer with not less than 10 years successful experience in the fabrication of assemblies of the type and quality required.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Installer shall have successfully completed not less than two projects of similar size, scope, and complexity as that of this Project within the last three years.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

D. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

F. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

G. Mockups: Build mockups to verify selections made under sample submittals, to demonstrate aesthetic effects, to demonstrate flashing of openings, and to set quality standards for fabrication and installation.

1. Build mockup of typical wall area as shown on Drawings.
2. Notify Architect and Owner’s Representative seven days in advance of dates and times when mockups will be constructed.
3. Field testing shall be performed on mockups according to requirements in "Field Quality Control" Article.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
5. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01. Review methods and procedures related to aluminum windows including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum storefront that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum storefront with other exterior

wall components. Include provisions for structural anchorage, glazing, flashing, weeping, sealants, and protection of finishes.

4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 COORDINATION

A. Coordinate doors, frames, door hardware, and other work for proper installation of door hardware, furnished under other Sections and installed in aluminum-framed entrance and storefront systems. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Structural failures including, but not limited to, excessive deflection.
    b. Noise or vibration caused by thermal movements.
    c. Deterioration of metals and other materials beyond normal weathering.
    d. Adhesive or cohesive sealant failures.
    e. Water leakage through fixed glazing and framing areas.
    f. Failure of operating components.

2. Warranty Period: 5 years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 20 years from date of Substantial Completion.

1.12 MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

    a. Coordinate with door hardware supplier for replacement of defective items.

3. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. EFCO Corporation
2. Kawneer North America; an Alcoa Company
3. Oldcastle BuildingEnvelope
4. Tubelite
5. Wausau Window and Wall Systems
6. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.
5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Center, unless otherwise indicated on Drawings.
4. Finish: High-performance organic finish.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Sill Pan: Provide high performance flashing by manufacturer. Extruded aluminum, factory fabricated to provide sealed end dams, finished to match storefront; designed to direct water away from building when installed horizontally at sill. If manufacturer offers a similar sill pan as part of aluminum-framed entrance and storefront system, submit details and product data including finishes, for consideration and approval by Architect. PVC is not acceptable.

E. Sill Extension: Extruded aluminum. Profile as indicated on Drawings.

F. Perimeter Filler: Provide perimeter filler / backer plate to close back of frame and facilitate placement of backer rod and sealant.

1. Back Plates: Furnish jamb and head framing members with manufacturer's standard continuous back plates, unless continuous plates are integral to the design of the framing system.

G. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

H. Concealed Flashing: Dead-soft, 0.018-inch thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.

I. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: As recommended by manufacturer for joint type and as follows:

1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with other system components with which it comes in contact; recommended by weatherseal-sealant and aluminum-framed-system manufacturers for this use.

2.5 ENTRANCE DOOR SYSTEMS

A. Aluminum Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 2-1/4 inches overall thickness, with minimum 0.125-inch thick, extruded-aluminum tubular rail and stile members. Mortise and tenon joinery at corner with full width 3/8-inch diameter tie rods secured with locking washers and hex nuts.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: Wide stile, 5-inch nominal width.

a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

2.6 ENTRANCE DOOR HARDWARE

A. General: Except for items specified in this Article, entrance door hardware to be furnished under Section 087100 "Door Hardware."

1. All hardware preparation and installation to be performed as Work of this Section.

B. Weather Stripping: Manufacturer's standard replaceable components.

1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylon-fabric or aluminum-strip backing.

2.7 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Section 079200 "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil thickness per coat.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At exterior doors, provide compression weather stripping at fixed stops.

2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.9 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Apply finishes to formed metal after fabrication unless otherwise indicated.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. General: Comply with the NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.

5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Provide fasteners at spacing as recommended by manufacturer.
7. Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Installation at Sill: Install sill pan system in accordance with manufacturer's written instructions.

1. Set sill pan in a continuous bed of low modulus sealant or apply a nominal 6 inch wide strip of 60 mil self-adhering waterproofing membrane to the bottom of the pan and where a penetration might be required to comply with specified performance requirements.
2. Do not apply sealant between flashing pan and bottom of frame, except as required by manufacturer to comply with specified performance requirements. Set sill members in watertight sill flashing pan. Do not penetrate bottom of flashing pan and/or attach sill members to vertical leg of angle unless required by manufacturer to comply with specified performance requirements.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 088000 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install weatherseal sealant according to Section 079200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

3.3 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
2. Alignment:

a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.4 FIELD QUALITY CONTROL

A. Contractor/Installer Testing: Contractor/Installer shall be prepared to provide the following minimum testing as part of the Work.

1. Testing shall be in compliance with AAMA 501.2. Testing shall be performed at approximately 10 percent and 50 percent completion. A minimum of 2 test areas to be tested at each phase. Additional testing may be required if installation crew changes of if construction is suspended and resumed after an extended period of time. Coordinate with Architect's representative for areas to be tested, testing times, and representative's availability to monitor tests.

B. Testing Agency: Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections.

C. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.

1. Air Infiltration: Areas shall be tested for air leakage of 1.5 times the rate specified for laboratory testing under "Performance Requirements" Article, but not more than 0.09 cfm/sq. ft., of fixed wall area when tested according to ASTM E 783 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft.
2. Water Penetration: Areas shall be tested according to ASTM E 1105 at a minimum uniform and cyclic static-air-pressure difference of 0.67 times the static-air-pressure difference specified for laboratory testing under Part 1 "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.

D. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Work under this section includes furnishing and the installation of finish and security hardware specified herein and noted on drawings for a complete and operational system, including any electrified door hardware components including finish and security hardware and auto operators for entrance doors.

Items include, but are not limited to:

1. Hinges
2. Exit Devices
3. Locksets and Cylinders
4. Push Plates - Pulls
5. Closers
6. Kick, Mop and Protection Plates
7. Stops, Wall Bumpers, Overhead Controls
8. Thresholds, Gasketing and Door Bottoms
9. Silencers
10. Miscellaneous Trim and Accessories
11. Electrified Hardware Items, Controls and Power Supplies

B. Related Sections:

1. Section 081113 "Hollow Metal Doors and Frames"
2. Section 081416 "Flush Wood Doors"
3. Section 084113 "Aluminum-Framed Entrances and Storefronts"
4. Division 26 - Electrical
5. Division 27 - Communications
6. Division 28 - Electronic Safety and Security

C. Alternates: Refer to Division 01 in the project manual for project alternates.

1.2 REFERENCES

A. The following references are used in this section.

1. NFPA 80 - Standard for Fire Doors, 2007.
2. Installation Guide for Doors and Hardware, DHI, 1984.
3. ANSI / BHMA A156.18, Materials and Finishes, 2006.

1.3 GENERAL REQUIREMENTS

A. Description of Work: Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on drawings, in quantities as required to complete project. Provide hardware that functions properly. Prior to furnishing hardware, advise Architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

1.4 SUBMITTALS

A. Hardware Schedule: Submit 5 copies of hardware schedule in vertical format as illustrated by the Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Schedules which do not comply will be returned for correction before checking.

B. Hardware schedule shall clearly indicate architect's hardware group and manufacturer of each item proposed.

C. The schedule shall be reviewed prior to submission by a certified Architectural Hardware Consultant (AHC), who shall affix his or her seal attesting to the completeness and correctness of the schedule.

1. Provide 2 copies of illustrations from manufacturer's catalogs and data in brochure form.
2. Check specified hardware for suitability and adaptability to details and surrounding conditions. Indicate unsuitable or incompatible items and proposed substitutions in hardware schedule.
3. Provide listing of manufacturer's template numbers for each item of hardware in hardware schedule.
4. Furnish other Contractors and Subcontractors concerned with copies of final approved hardware schedule. Submit necessary templates and schedules as soon as possible to hollow metal, wood door, and aluminum door fabricators in accordance with schedule they require for fabrication.
5. Samples: Lever design or finish sample: Provide 3 samples if requested by architect.

D. Wiring Diagrams: Provide complete and detailed system operation and elevation diagrams specially developed for each opening requiring electrified hardware, except openings where only magnetic hold-opens or door position switches are specified. Provide these diagrams with hardware schedule submittal for approval. Provide detailed wiring diagrams with hardware delivery to jobsite.

E. Installation Instructions: Provide manufacturer's written installation and adjustment instructions for finish hardware. Send installation instructions to site with hardware.

F. Templates: Submit templates and "reviewed Hardware Schedule" to door and frame supplier and others as applicable to enable proper and accurate sizing and locations of cutouts and reinforcing.

G. Contract Closeout Submittals: Comply with Section 01700 including specific requirements indicated below.

1. Operating and maintenance manuals: Submit 3 sets containing the following:
2. Complete information in care, maintenance, and adjustment, and data on repair and replacement parts, and information on preservation of finishes.
3. Catalog pages for each product.
4. Name, address, and phone number of local representative for each manufacturer.
5. Parts list for each product.
6. Copy of final approved hardware schedule, edited to reflect "As installed".
7. Copy of final keying schedule.
8. As installed "Wiring Diagrams" for each opening connected to power, both low voltage and 110 volts.
9. One complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.5 QUALITY ASSURANCE

A. General Contractor's Investigation: Prior to Contract Execution, the General Contractor shall have thoroughly investigated the entities that will be performing work or supplying materials, products, equipment, or systems for this project, to ensure that they comply with all of the qualifications and requirements mentioned or implied in the Contract Documents. If it is later determined that any of the previously mentioned entities do not comply with the qualifications and requirements specified in the Contract Documents, the General Contractor will be required to replace that entity with a qualified entity at no increase in Contract Sum or Contract Time.

B. Manufacturer: Obtain each type of hardware (ie. latch and locksets, hinges, closers) from single manufacturer, although several may be indicated as offering products complying with requirements.

C. Qualifications of the Hardware Supplier: A recognized architectural door hardware supplier, with warehousing facilities, who has been furnishing hardware and installation in the Project's vicinity for a period of not less than 4 years. The supplier shall be, or shall employ, an Architectural Hardware Consultant (AHC) who is available, at reasonable times during the course of the work, for consultation about the Project's hardware requirements, to the Owner, Architect, and Contractor. An Architectural Hardware Consultant (AHC) shall prepare all hardware and access control schedules. This Supplier shall be responsible for proper coordination of all finish hardware items and access control items with related sections to insure compatibility of products.

1. Hardware supplier must be an authorized, direct factory distributor of all door hardware products specified herein to insure compliance and service of these products.
2. Require supplier to meet with Owner to finalize keying requirements and to obtain final instructions in writing.

D. Qualifications of Installer: The hardware installer shall have documented experience in the installation of hardware of similar quantities and types as required for this project. The installer's qualifications shall be submitted to the architect, in writing, for approval by the architect before any work shall commence.

E. Fire-Rated Openings: Furnish door hardware for fire-rated openings that complies with NFPA Standard No. 80 and requirements of the Authorities Having Jurisdiction. Furnish only items, of door hardware, that are listed and are identical to products tested by UL, ITS-WH, FM, or other testing and inspecting organization acceptable to the Authorities Having Jurisdiction, for use on types and sizes of doors indicated, in compliance with the requirements of fire-rated door and door frame labels.

Project requires door assemblies and components that are compliant with positive pressure and S Label requirements. Specifications must be cross-referenced and coordinated with door and frame manufacturers to ensure that total door opening engineering is compatible with UL10C Standard for Positive Pressure Fire Tests of Door Assemblies.

Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels including "Fire Door to be Equipped with Fire Exit Hardware") provide UL/WHI or FM label on exit devices indicating "Fire Exit Hardware".

F. Substitutions: All substitution requests are required to be submitted prior to the bid date and complying with the procedures and time frame as outlined in Division 01, General Requirements. Approval of submitted products is at the discretion of the architect and his hardware consultant.

G. At the Project's Completion, the Owner's Representative shall accompany the Architect and General Contractor during the Door Hardware and Access Control Items punch list phase of the project close-out, insuring the Owner's Representative is familiar with all applications and systems, as installed. Refer to additional requirements under 3.0 EXECUTION.

H. Pre-Installation Meeting: Prior to door hardware installation, the General Contractor / Construction Manager shall request a hardware installation meeting to be held at the project location. This meeting shall convene prior to the hardware's installation. The types of hardware this meeting shall include are: locksets, exit devices, and door closers. The manufacturer's representatives of the above listed products, in conjunction with the hardware supplier for this project, shall conduct the installation training. All hardware installers shall be required to attend this meeting to receive certificate of authorized training. This meeting shall serve as door openings coordination and review of all shop drawings from related trades prior to the hardware installation. The Hardware Supplier shall include any related meeting costs in their proposal.

I. Electrified Hardware and Security Hardware Systems: Prior to ordering the electrified hardware, the General Contractor shall request a coordination meeting. This meeting shall convene prior to or after the Door Hardware Schedule and the wiring diagrams have been submitted to the General Contractor. All related trades shall be represented at this meeting, which shall also include the architect, the Owner's representative, the hardware supplier, and the hardware manufacturer's representative as requested. This

meeting shall serve as a review and coordination of all electrified hardware, wiring, connections, location for power supplies, and remote switches, and door functions. All related trades shall make any required changes, and resubmit schedules, diagrams, and any other required data, no later than one (1) week following this meeting.

1.6 DELIVERY, STORAGE AND HANDLING

A. Tag each item or package separately with identification related to final hardware schedule, and include basic installation instructions with each item or package.

B. Packaging of door hardware is the responsibility of the supplier. As material is received by the hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set numbers to match the set numbers of the approved hardware schedule. Two or more identical sets may be packed in the same container.

C. The door hardware supplier shall deliver all individually packaged hardware items in a timely fashion to the place of installation (Shop or Project Site); direct factory shipments are not acceptable unless agreed upon beforehand. Hardware supplier shall coordinate delivery times and schedules with the contractor.

D. The General Contractor, door hardware supplier, access control supplier, and installers shall count, coordinate, and store all door hardware and access control items herein, verifying complete counts of all items scheduled and furnished. The contractor must report all shortages (discrepancies with shipping documents) within five (5) working days. The manufacturers' and Owner's representatives will inspect the installation of the door hardware and access control items during that phase of construction. Any deficiencies in installation of all materials included herein shall be corrected before installation continues.

E. The General Contractor shall provide a secure lock-up for the door hardware and security equipment delivered to the Project, but not yet installed. Control handling and installation of the hardware items that are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.7 WARRANTY

A. All materials must be warranted against defects in workmanship and materials for a period of one (1) year from date of acceptance of this project, unless otherwise noted. Any evidence of misuse or abuse voids all warranties. These warranties shall be each manufacturers' standard written warranty.

B. Special Warranties:

1. Continuous Geared Hinges: Life of the Door Opening.
2. Mortise Latchsets and Locksets: Three (3) Year Period.
3. Exit Devices: Three (3) Year Period.
4. Door Closers: Thirty (30) Year Period.
5. Electromagnetic Door Holders: Two (2) Year Period.
6. Saddle Thresholds, Bumper Thresholds, Door Sweeps, Self-Adhesive Gasketing, Perimeter Seals, Astragal Seals, Self-Adhesive Astragal Gasketing, Mullion Seals, Interlocking Seals, and Drip Strips: Three (3) Year Period.

C. Any manufacturer whose standard written warranty does not equal or exceed the requirements listed above must provide a letter stating that they will extend their warranty to comply with the requirements of this specification.

D. All of the manufacturer's fasteners and attachments supplied with each hardware item must be installed to maintain the manufacturer's fire listing and/or warranty.

E. Refer to Section 01 - Closeout Procedures for additional warranty requirements.

1.8 MAINTENANCE

A. Maintenance Tools and Instructions: General Contractor shall furnish a complete set of specialized tools and maintenance instructions as needed for the Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 BUTTS AND HINGES

A. Acceptable Manufacturers:

Ives	Bommer	Stanley
5BB1	BB5000	FBB179
5BB1	BB5001	FBB191
5BB1HW	BB5004	FBB168
5BB1HW	BB5005	FBB199

B. Application: Provide NRP (non-removable pins) at out-swinging lockable doors.

C. Quantity:

1. Two hinges per leaf for openings through 60 inches high.
2. One additional hinge per leaf for each additional 30 inches in height or fraction thereof.
3. Four hinges for Dutch doors up to 90 inches in height.

2.2 ELECTRIC POWER TRANSFER

A. Acceptable manufacturers:

Von Duprin	Security Door Controls	Securitron
EPT-10	PTM-10	CEPT

B. Provide power transfer sufficient for number and gage of wires to accommodate electric function of specified hardware.

C. Electric power transfer is to be located per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.3 LOCKSETS – CYLINDRICAL

A. Acceptable Manufacturer and Series:

Falcon	Best	Corbin Russwin	Sargent
T Series x DANE	9K x LM Series x 15D	CL3300 Series x NZD	FW-10 Series x LL

Schlage	Yale
ND Series x RHO	5400LN Series x AU

1. Characteristics:

   a. Tested to be in accordance with or exceed ANSI / BHMA A156.2, Series 4000, Grade 1 Strength and Operational requirements.
   b. U.L. Listed for 3-hour doors.
   c. Locksets shall be non-handed.
   d. Chassis: Cylindrical housing design, heavy gauge, cold rolled steel mechanisms, corrosion treated for normal atmosphere conditions.
   e. Locksets shall have separate anti-rotational through-bolts for positive mounting / interlocking to the door, without any exposed mounting screws.
   f. Locksets shall have solid cast levers, plated to match the specified finish symbols. Levers shall operate independently, and shall have separate, heavy duty, lever return springs or spring cages, allowing for a smooth operation of the lockset, for effective lever support, which shall prevent lever sag. Outside lever handles shall be a minimum of 4-5/8" in length and shall provide a minimum of 2" clearance from the surface of the door to the inside of the lever, at the midpoint. Outside lever handles shall return to within, a maximum, of 1/2" of the door surface.
   g. Outside lever handles, on keyed locksets, shall be removable only when the designated key is in the cylinder.
   h. When the outside lever handle is locked, the lever shall rotate freely and shall return to its horizontal position when released. The locked outside lever handle shall freely rotate up and down while remaining securely locked.
   i. Roses: Wrought brass, bronze or stainless steel, plated to match the specified finish symbols. Roses shall be a minimum 3-7/16" in diameter, for coverage of the ANSI / DHI A115.18 - 1994 door preparation.
   j. All locksets shall be furnished with a 1/2" throw latchbolt and shall be listed by Underwriter's Laboratories, Inc. for A label and lesser class 4'-0" x 10'-0" single doors.
   k. Backsets: 2-3/4" (70mm).
   l. Strike: Brass, bronze or stainless steel, plated to match the specified finish symbols. Conform to ANSI A115.2 (4-7/8" x 1-1/4"), with lips of a sufficient length to clear trim and protect clothing.
   m. Furnish "Abrasive" outside levers; as indicated in Door Hardware Sets.

2.4 EXIT DEVICES

A. Manufacturers and Products:

Falcon	Detex	Precision	Von Duprin	Sargent
24 / 25 Series	Advantex Series	Apex Series	35A / 98 Series	80 Series

Corbin Russwin	Yale
ED4000 / ED5000 Series	7000 Series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Exit Devices: Touchpad type, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish or provide compatible finish. Provide compression springs in devices, latches, and outside trims or controls, tension springs also acceptable.

4. Provide devices with deadlatching feature for security and for future addition of alarm kits and other electrical requirements.
5. Provide manufacturer's standard strikes.
6. Provide exit devices cut to door width and height. Locate exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
7. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
8. Provide cylinder dogging at non-fire-rated exit devices.
9. Removable Mullions: 2 inches x 3 inches steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
10. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.
    a. Lever Style: Match lever style of locksets.
11. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.
12. Provide UL labeled fire exit hardware for fire rated openings.
13. Field drill weep holes per manufacturer’s recommendation for exit devices used in full exterior application, highly corrosive areas, and where noted in the hardware sets.
14. Provide electrified options as scheduled in the hardware sets.

2.5 ELECTRIC STRIKES

A. Acceptable Manufacturers and Series:

Von Duprin	Folger-Adam	Rutherford
6000 Series	310 Series	6 Series

B. Provide electric strikes designed for use with the type locks shown at each opening where specified.

C. Electric Strikes shall be UL Listed as Burglary-Resistant Electric Door Strikes and where required shall be UL Listed as Electric Strikes for Fire Doors and Frames. Provide fail-secure type electric strikes, unless specified otherwise.

D. Provide transformers and rectifiers for each strike as required. Verify voltage with electrical contractor.

2.6 MAGNETIC LOCKS

A. Acceptable Manufacturers and Series:

Schlage	Security Door Controls	Securitron
M490P	1511	M82B Series

B. Magnetic locks shall meet ANSI/BHMA A156.23-1992 classification criteria including a minimum holding force of 1500 LBF.

C. Provide locks with a SPDT Magnetic Bond Sensing device to monitor whether sufficient magnetic holding force exists to ensure adequate locking. The bond sensor shall be fully concealed within the electromagnet to resist tampering or damage.

D. Provide locks with built in Door Status Monitoring and automatic voltage selection.

E. Magnetic locks shall be equipped with a concealed adjustable time delay option to re-lock the door, adjustable from 1 to 90 seconds.

F. Provide power supplies for magnetic locks by the same manufacturer as locks.

G. Provide fasteners, mounting brackets, and spacer bars required to suit details.

2.7 KEYING

A. Master key or Grand master key cylinders and key in groups, unless otherwise specified. Factory masterkey with manufacturer retaining permanent keying records.

B. Provide 6 masterkeys for each masterkey set. Provide 3 change keys for each lock. Provide 2 control keys for core removal. Stamp keys "DO NOT DUPLICATE."

C. Submit proposed keying schedule to Architect. If requested, meet with Owner and Architect to review schedule.

D. Provide removable core cylinders, with patented key control, for each lock with temporary keyed brass construction cores. Permanent cores shall be installed upon completion of the project.

2.8 DOOR TRIM

A. Acceptable Manufacturers and Types:

Ives	Trimco	Burns
8200	1001-9	56
8303	1018-3B	5426C
9100	1741	422
8190	1191-3	29C
8103-0	1195-2	26C
8102-8	1194-2	25B

B. Push Plates:

1. Ives type 8200 6 inches by 16 inch unless otherwise indicated.
2. Where width of door stile prevents use of 6 inch wide plate, provide push plate one inch less than width of stile but not less than 4 inches wide.

C. Pull Plates: Ives type 8303 4 inches by 16 inches unless otherwise indicated.

D. Push Bars: Ives type 9100, unless otherwise indicated.

E. Pulls:

1. Ives Series 8190, unless otherwise indicated.
2. Where required, mount back to back with push bars.

F. Kick Plates and Armor Plates: Ives 8400 Series, minimum of 0.050 inch thick, beveled 4 edges.

1. At single doors provide width two inches less than door width on stop side and one inch less than door width on pull side.
2. At pairs of doors provide width one inch less than door width on both sides.
3. Height of 10 inches, unless otherwise indicated.
4. Provide plates with countersunk screw holes.

2.9 DOOR CLOSERS

A. Acceptable Manufacturers and Types of Medium Bore Exposed Closers:

LCN	Sargent	Norton
1450 Series	1431 Series	8501/8501BF Series

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
2. Provide door closers with fully hydraulic, full rack and pinion action with cast aluminum cylinder.
3. Closer Body: 1-1/4 inch (32 mm) diameter, with 5/8 inch (16 mm) diameter heat-treated pinion journal and full complement bearings.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and back check.
7. Pressure Relief Valve (PRV) Technology: not permitted.
8. Provide stick on and special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.10 OVERHEAD STOPS

A. Acceptable Manufacturers

Glynn Johnson	Rixson	Sargent
90	9 Series	590 Series

B. Provide overhead stops for interior doors equipped with regular arm surface type closer for doors that open against equipment, casework, sidelights, other objects that would make wall stops inappropriate.

C. Provide sex bolt attachments for mineral core door application.

2.11 WALL STOPS AND HOLDERS

A. Acceptable Manufacturers and Types:

Ives	Trimco	Door Controls
WS406/407CCV	1270WVP	3211T

B. Provide WS406/407CCV Series wall stop for each door leaf unless otherwise specified, or where conditions require the use of an overhead stop.

C. Floor or base stops shall be used only where definitely specified or absolutely unavoidable.

2.12 THRESHOLDS

A. Acceptable Manufacturers and Product:

National Guard	Reese	Zero
425E	S425A	8655A

B. Where thresholds are specified in hardware groups, provide 8655A thresholds unless detailed otherwise.

C. Refer to drawings for special details. Provide accessories, shims and fasteners.

D. Where thresholds occur at openings with one or more mullions, they shall be cut for the mullions and extended continuously for the entire opening.

2.13 WEATHERSTRIPPING

A. Acceptable Manufacturers and Product:

	National Guard	Reese	Zero
Sweeps	201NA	323C	39A
Jambs	700SA	755C	429A
Rain Drips	16A	R201C	142A

B. Where weatherstripping is specified in hardware groups, provide 429A unless detailed otherwise.

C. Provide self-tapping fasteners for weatherstripping being applied to hollow metal frames.

D. Where sweeps are specified in hardware groups, provide 39A unless detailed otherwise.

E. Where rain drips are specified in hardware groups, provide 142A x full frame width, unless detailed otherwise.

2.14 GASKETING

A. Acceptable Manufacturers:

National Guard	Reese	Zero
5050	F-797B	188S

B. Where smoke gasket is specified in hardware groups, provide 188S, unless detailed otherwise.

C. Provide gaskets for 20-minute doors and doors designated for smoke and draft control.

D. Where frame applied intumescent seals are required by the manufacturer, provide gaskets that comply with UBC 7-2, 1997 and UL 10C positive pressure tests.

2.15 SILENCERS

A. Acceptable Manufacturers and types:

Ives	Steelcraft	Don-Jo
SR64	Q146	1608

B. Provide grey rubber silencers featuring pneumatic design that, once installed, forms an air pocket to absorb shock and reduce noise of door closing.

C. Provide three (3) silencers per hollow metal strike jamb; two (2) per hollow metal double door head. Omit at doors scheduled to receive perimeter weatherstripping or smoke gasket.

D. Silencers shall meet ANSI/BHMA A156.16, L03011

2.16 FASTENERS

A. Including, but not limited to, wood or machine screws, bolts, bolts, nuts, anchors, etc. of proper type, material, and finish required for installation of hardware.

B. Use phillips head for exposed screws. Do not use aluminum screws to attach hardware.

C. Provide self-tapping (TEC) screws for attachment of sweeps and stop-applied weatherstripping only.

2.17 TYPICAL FINISHES AND MATERIALS

A. Finishes, unless otherwise specified:

1. Butts: Outswinging Exterior Doors: US32D (BHMA 630) on Stainless Steel
2. Butts: Interior Doors and Inswinging Exterior Doors: US26D (BHMA 652) on Steel
3. Exit Devices: US26D (BHMA 626) on Brass or Bronze
4. Locks and Latches: US26D (BHMA 626) on Brass or Bronze
5. Push Plates, Pulls and Push Bars: US32D (BHMA 630) on Stainless Steel
6. Kick Plates, Armor Plates, and Edge Guards: US32D (BHMA 630) on Stainless Steel
7. Overhead Stops and Holders: US26D (BHMA 626) on Brass or Bronze
8. Closers: Surface mounted.
    a. Sprayed Aluminum Lacquer.
9. Miscellaneous Hardware: US26D (BHMA 626) on Brass or Bronze

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors, frames, and related items for conditions that would prevent the proper application of finish hardware. Do not proceed until defects are corrected.

3.2 INSTALLATION

A. Mount hardware units at heights indicated in the following applicable publications, except as specifically indicated or required to comply with governing regulations and, except as otherwise indicated, by the Architect.

1. “Recommended Locations for Builders Hardware for Standard Steel Doors and Frames” by the Door and Hardware Institute.

B. Install each hardware item in compliance with the manufacturer’s instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 09 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

C. Sets units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Where scheduled, door pulls shall be through-bolted with bolt heads concealed behind push plates.

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

F. Set thresholds, for exterior and interior doors, in a full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 07 - Joint Sealers.

G. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

H. The hardware installer shall be responsible for installation of all mechanical and electromechanical hardware items contained within this specification, in accordance with the manufacturer's technical installation guidance, and in addition to all applicable code requirements.

I. The Electrical Sub-Contractor, under Division 26 - Electrical, shall be responsible for providing and installing all (120 VAC) power source wiring as required for the electrified locking and access control hardware, equipment, accessories, and power supplies. This includes quad outlets as required on a dedicated circuit in designated IT / Telecommunication Room(s) and the related conduit, stud-ins, junction boxes, and connectors required for the power source delivery and connections. Provide cabling, conduit, stub-ins, patch cords, fire stop systems, data connectors, junction boxes, and back boxes for both the electrified locking hardware and access control equipment at each of the access controlled or monitored openings per plan drawings and specifications. Provide and install conduit between each of the aforementioned devices and between junction boxes, power supplies, and access control equipment located on or above each door opening.

1. At wall mounted remote card readers, provide conduit on the secured side of each door opening, at 48" from above the finished floor and 6" from the edge of each door frame, to the related power supplies and access control equipment; unless otherwise instructed by Architect.
2. At all electrical hardware power transfer items provide conduit on the secured side of each door opening, from the power transfer items, through-wire hinges, or serviceable panel locations, inside of frame's jambs, to the related power supplies and access control equipment.
3. Installation of power supplies and interfacing of security system with fire alarm system as required, and coordination of complete security system shall be provided by the Electrical Sub-Contractor, under the Division 26 - Electrical. Electrical Sub-Contractor shall be responsible for providing and installing all 120 VAC cabling connections and terminations from the electrical junction boxes to these electrical devices.

J. The Access Control System's supplier shall be responsible for providing all low-voltage (12 / 24 VDC) wiring and communication cabling (RS-232 / RS-485) installation from network control processors to reader controllers, I / O monitor / control interface panels, electrified and integrated locking hardware, remote card readers, keypads, or display terminals, monitoring and signaling switches, and power supplies, identification, and termination in accordance with the manufacturer's technical installation guidance, in addition to all applicable code requirements. Installation of all card readers, controllers, software packages, door position switches, and run low voltage wiring from the power supplies / controllers to the electrified hardware items at each opening where specified. The Access Control System's installer shall also be responsible for connectors, final wire terminations, final hook-ups, testing, system set-up, warranty, and Owner Turnover. Owner Training shall be provided under this Section.

K. Upon completion of the final installation of the Door Hardware and Access Control System, and burn in of the Security System, the Contract Hardware Distributor and the Access Control System's Supplier shall jointly make final adjustments to the electrified hardware and Access Control System's openings to insure proper adjustment and function of the opening is in compliance with the system's functionality requirements.

3.3 FIELD QUALITY CONTROL

A. After installation has been completed, provide services of qualified hardware consultant to check Project to determine proper application of finish hardware according to schedule. Also check operation and adjustment of hardware items.

B. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

3.4 ADJUSTING AND CLEANING

A. At final completion, hardware shall be left clean and free from disfigurement. Make final adjustment to door closers and other items of hardware. Where hardware is found defective repair or replace or otherwise correct as directed.

B. Adjust door closers to meet opening force requirements of Uniform Federal Accessibility Standards.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of space or area, return to work during week prior to acceptance or occupancy, and make final check and adjustment of hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors.

D. Instruct Owner's personnel in proper adjustment and maintenance of door hardware and hardware finishes.

E. Clean adjacent surfaces soiled by hardware installation.

3.5 PROTECTION

A. Provide for proper protection of items of hardware until Owner accepts Project as complete.

3.6 HARDWARE GROUPS

A. The hardware supplier is cautioned to refer to general conditions, special conditions, and the preamble to this section. It shall be the hardware supplier's responsibility to furnish all required hardware.

B. Refer to the hardware groups below for door hardware required at each door opening.

Hardware Group No. EXT-01

For use on mark/door #(s):
A15-R A15-S A15-V A15-W A15-X

Provide each RU door(s) with the following:

Qty	Description	Catalog Number	Finish	Mfr
		HARDWARE BY MANUFACTURER		

PROVIDE KEY CYLINDER AND CORE AS REQUIRED FOR LOCKING PURPOSES.

Hardware Group No. EXT-02

For use on mark/door #(s):
A15-T A15-U

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	MEL-25-R-NL	626	FAL

1	EA	RIM HOUSING	C953	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	SURFACE CLOSER	1450 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	8665A-223	A	ZER
			CARD READER - WORK OF DIVISION 28		
			POWER SUPPLY - WORK OF DIVISION 28		

COORDINATE WITH ELECTRICAL AND SECURITY SYSTEMS.

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL PRESENTED TO READER ON EXTERIOR WILL MOMENTARILY UNLOCK DOOR AND ALLOW ENTRY.

FREE EGRESS ALWAYS ALLOWED.

Hardware Group No. INT-01

For use on mark/door #(s):
A15-Y A15-Z

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	630	IVE
1	EA	MAGNETIC LOCK	M490	628	SCE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	1450 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE
			CARD READER - WORK OF DIVISION 28		
			POWER SUPPLY - WORK OF DIVISION 28		

DOOR NORMALLY CLOSED AND LOCKED FROM BOTH SIDES.

PRESENTING VALID CREDENTIAL TO READER ON EITHER SIDE WILL MOMENTARILY UNLOCK DOOR AND ALLOW PASSAGE.

WHEN FIRE ALARM SOUNDS OR POWER IS LOST, MAGNETIC LOCK WILL RELEASE AND DOOR WILL BE FREE EGRESS FROM BOTH SIDES.

Hardware Group No. INT-02

For use on mark/door #(s):
170-X 185-X

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	T581B DANE	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	ELECTRIC STRIKE	6211 FS	630	VON
1	EA	SURFACE CLOSER	1450 REG OR PA AS REQ	689	LCN
1	EA	KICK PLATE	8400 10" X 1 1/2" LDW B-CS	630	IVE

1	EA	WALL STOP	WS406/407CCV CARD READER - WORK OF DIVISION 28 POWER SUPPLY - WORK OF DIVISION 28	626	IVE

NOTE: USE 5" X 4.5" HINGES AT DOOR 170-X.

COORDINATE WITH ELECTRICAL AND SECURITY SYSTEMS.

DOOR NORMALLY CLOSED AND LOCKED. VALID CREDENTIAL PRESENTED TO READER ON PUSH SIDE WILL MOMENTARILY UNLOCK ELECTRIC STRIKE AND ALLOW ENTRY.

FREE EGRESS ALWAYS ALLOWED.

Hardware Group No. INT-03

For use on mark/door #(s):

171-X	172-X	176-X	177-X	178-X	189-X
190-X	192-X	193-X	195-X		

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRY / OFFICE LOCK	T521B DANE	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	WALL STOP	WS406/407CCV	626	IVE

Hardware Group No. INT-04

For use on mark/door #(s):

173-X	180-X	181-X	182-X	188-X	196-X

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	T581B DANE	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	WALL STOP	WS406/407CCV	626	IVE

Hardware Group No. INT-05

For use on mark/door #(s):

191-X	197-X

Provide each SGL door(s) with the following:

Qty		Description	Catalog Number	Finish	Mfr
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	T581B DANE	626	FAL
1	EA	SFIC CORE	C607	626	FAL
1	EA	OH STOP	90S	630	GLY

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Doors.
2. Storefront framing.
3. Glazed entrances.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.
3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Roller Wave Distortion: Maximum of 0.003 inch from peak to valley in the center of lite, and a maximum of 0.008 inch within 10.5 inches of the leading or trailing edge.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of the following products; 12 inches square.

1. Insulating glass.

C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For glass and glazing products, from manufacturer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for coated glass, insulating glass, glazing sealants and glazing gaskets.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

C. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain tinted float glass, coated float glass, and insulating glass from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

E. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.

F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

1. Provide safety glazing labeling.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.

2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of Kind FT (Fully Tempered) and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

B. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article.

2.4 MONOLITHIC-GLASS TYPES

A. Glass Type: Clear fully tempered float glass, minimum 1/4 inch thick.

2.5 INSULATING-GLASS TYPES

A. Glass Type: Low-e-coated, tinted insulating glass.

1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 1/4 inch.
3. Outdoor Lite: Tinted, fully tempered float glass.
    a. Manufacturers:
        1) Guardian Industries Corp
        2) AGC Glass Company
        3) Vitro Glass
    b. Low-E Coating: Sputtered on second surface.
    c. Tint: Match existing glazing in Hold Room.
4. Interspace Content: Air or argon.
5. Indoor Lite: Clear, fully tempered float glass.

2.6 GLAZING GASKETS

A. Compression Gaskets: Molded or extruded gaskets of type and material indicated below and of profile and hardness required to maintain watertight seal:

1. Silicone dense compression gaskets complying with ASTM C 1115.
2. Silicone soft compression gaskets complying with ASTM C 509, Type II, black.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, provide the following:

a. Dow Corning Corporation; 790
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700
c. May National Associates, Inc.; Bondaflex Sil 290
d. Pecora Corporation; 890
e. Sika Corporation, Construction Products Division; SikaSil-C990
f. Tremco Incorporated; Spectrem 1

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Final Acceptance. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 089119 - FIXED LOUVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes fixed, extruded-aluminum louvers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

C. Samples: For each type of metal finish required.

D. Delegated-Design Submittal: For louvers indicated to comply with structural performance requirements, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

B. Windborne-debris-impact-resistance test reports.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.6 WARRANTY

A. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design louvers, including comprehensive engineering analysis by a qualified professional engineer, using structural performance requirements and design criteria indicated.

B. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

C. Windborne-Debris-Impact Resistance: Louvers located within 30 feet of grade shall pass basic-protection, large-missile testing requirements in ASTM E 1996 for Wind Zone 3 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than louvers indicated for use on Project.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

F. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.2 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Wind-Driven-Rain-Resistant Louver:

1. Basis of Design: Subject to compliance with requirements, provide basis of design indicated or comparable products by one of the following:

a. Greenheck Fan Corporation; ESD-635D (Basis of Design)
b. Airolite Company, LLC (The).
c. American Warming and Ventilating; a Mestek Architectural Group company.
d. Architectural Louvers
e. Arrow United Industries; a division of Mestek, Inc.
f. Construction Specialties, Inc.
g. Industrial Louvers Inc.
h. Nystrom Building Products
i. Reliable Products, Inc.
j. Ruskin Company

2. Louver Depth: 6 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.081 inch for blades and 0.125 inch for frames.
4. Louver Performance Ratings:

a. Free Area: Not less than 9.41 sq. ft. (59 percent) for 48-inch-wide by 48-inch-high louver.
b. Air Performance: Not more than 0.10-inch wg static pressure drop at 600-fpm free-area intake velocity.

c. Wind-Driven Rain Performance: Not less than 99 percent effectiveness when subjected to a rainfall rate of 3 inches per hour and a wind speed of 29 mph at a core-area intake velocity of 300 fpm.

5. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.3 LOUVER SCREENS

A. General: Provide screen on the interior face of each exterior louver.

B. Secure screen frames to louver frames with stainless-steel machine screws with heads finished to match louver, spaced a maximum of 6 inches from each corner and at 12 inches o.c.

C. Louver Screen Frames: Fabricate with mitered corners to louver sizes indicated.

1. Metal: Same type and form of metal as indicated for louver to which screens are attached. Reinforce extruded-aluminum screen frames at corners with clips.
2. Finish: Same finish as louver frames to which louver screens are attached.
3. Type: Rewirable frames with a driven spline or insert.

D. Louver Screening for Aluminum Louvers:

1. Bird Screening: Flattened, expanded aluminum, 3/4 by 0.050 inch thick.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
4. For fastening stainless steel, use 300 series stainless-steel fasteners.
5. For color-finished louvers, use fasteners with heads that match color of louvers.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.5 FABRICATION

A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

B. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

D. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

3.2 ADJUSTING

A. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

END OF SECTION 089119

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes non-load-bearing steel framing members for the following applications:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Grid suspension systems for interior gypsum ceilings and soffits.

B. Related Sections:

1. Section 092900 "Gypsum Board" for gypsum panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Indicate yield strength of steel, section properties, limiting heights and spans.

1.4 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For dimpled steel studs and runners and firestop tracks, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Structural Properties: Manufacturer's published data on Structural Properties are calculated based on allowable stress design conforming to AISI "Specification of the Design of Cold-Formed Steel Structural Members."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Conventional Steel Framing: Subject to compliance with requirements, provide products by one of the following:

1. Allsteel & Gypsum Products, Inc.
2. Craco Manufacturing Inc.

3. Southeastern Stud and Components
4. Steel Construction Systems
5. The Formetal Co. Inc.
6. The Steel Network
7. Steelform USA

B. Dimpled/Knurled Studs: Subject to compliance with requirements, provide products by one of the following:

1. ClarkDietrich Building Systems: ProStud 20 and ProStud 22.
2. MarinoWARE: Viper 20S.
3. Telling Industries: Viper 20S.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

   a. Steel having a yield strength greater than 33 KSI is permitted.

2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized, unless otherwise indicated. Equivalent coatings are not acceptable and not allowed.

B. Minimum Base-Metal Thickness: Provide minimum base metal thickness specified or greater as required by the manufacturer's published performance data based on the following criteria:

1. Yield Strength of steel.
2. Deflection Limits:

   a. Gypsum Wallboard: L/240.
   b. Ceramic Tile: L/360.

3. Limiting heights: As indicated on Drawings.
4. Spans: As indicated on Drawings or as recommended by manufacturer.
5. Applied loads:

   a. Gypsum wallboard: 10 psf.
   b. Ceramic tile, one side: 15 psf.
   c. Ceramic tile, two sides: 30 psf.

6. Depth: As indicated on Drawings.

C. Studs and Runners: ASTM C 645. Use either conventional steel studs and runners or dimpled steel studs and runners.

1. At standard gypsum board partitions.

   a. Conventional Studs: 0.027 inch (22 ga.).
   b. Dimpled Studs: 0.0179 inch, at 70 ksi yield strength (22 ga. equivalent).
   c. Dimpled Studs: 0.0190 inch, at 50 ksi yield strength (20 ga. equivalent).

2. At tile backer panels and supporting wall-hung cabinets.

   a. Conventional Studs: 0.0312 inch (20 ga.).
   b. Dimpled Studs: 0.022 inch, at 65 ksi yield strength (20 ga. equivalent).
   c. Dimpled Studs: 0.0190 inch, at 50 ksi yield strength (20 ga. equivalent).

3. Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

E. Flexible Steel Tracks: For construction of curved walls and soffits, provide one of the following:

1. Flex-C Trac and Flex-C-Angle by Flexibility Concepts
2. Contour Track by Dietrich Industries.
3. Radius Track Corporation

F. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip
b. Grace Construction Products; FlameSafe FlowTrak System
c. Marino/WARE; Fas Track
d. Metal-Lite, Inc.; The System

G. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.033 inch.
2. Backing Plates (Contractor's Option): In lieu of flat steel straps, provide ClarkDietrich Danback fire-retardant treated flexible wood backing plates system for the attachment of cabinets, handrails, and wall fixtures. Provide fire-retardant wood in rated walls.

H. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches or as indicated on Drawings.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

I. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.033 inch.
2. Depth: As indicated on Drawings.

J. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

K. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Cast-in-place anchor, designed for attachment to concrete forms or Postinstalled, expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.033 inch.
b. Depth: As indicated on Drawings.

3. Dimpled Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.025 inch.
b. Depth: As indicated on Drawings.

4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base-Metal Thickness: 0.033 inch.

5. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.
b. Basis of Design: RC Deluxe by ClarkDietrich.

F. Grid Suspension System for Gypsum Board Ceilings (Contractor's Option): ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Grid System.
c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction. Space studs as indicated on Drawings.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    a. Install two studs at each jamb, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:
    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Source Limitations: Provide gypsum products manufactured within the United States from materials free of sulfur, formaldehyde or other deleterious chemicals. Natural gypsum ore shall be mined in North America. Synthetic (by-product) gypsum shall be pure calcium sulfate from domestic sources.

B. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for each level of gypsum board finish indicated for use in exposed locations.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Approved mockups will become part of the completed Work at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

1. Installation of gypsum panels before areas are enclosed and conditioned is done at Contractor's own risk. Damaged panels shall be removed and new panels installed at Contractor's expense and will not be deemed cause for additional time.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1. Fire-Resistance-Rated Assemblies: Indicated by design designations from UL's "Fire Resistance Directory".

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 PANELS, GENERAL

A. General: Complying with ASTM C 1396.

B. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. Certainteed Corporation
3. Georgia-Pacific Gypsum LLC
4. Lafarge North America Inc.
5. National Gypsum Company
6. Temple-Inland Inc.
7. USG Corporation.

B. Gypsum Board:

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
3. Location: Vertical surfaces, unless otherwise indicated.

C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: As required to meet radius indicated on Drawings.
2. Long Edges: Tapered.

D. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.

2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.

E. Impact-Resistant Gypsum Board:

1. Core: 5/8 inch, Type X.
2. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
4. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
5. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 2 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

F. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.
3. Provide moisture- and mold-resistant where indicated on Drawings.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Core: 5/8-inch, Type X.
2. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:

a. Cornerbead: Use at outside corners, unless otherwise indicated.
b. Bullnose Bead: Use where indicated.
c. LC-Bead: J-shaped; exposed long flange receives joint compound.
d. L-Bead: L-shaped; exposed long leg receives joint compound; use at exposed terminations of gypsum board panels.
e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
f. Expansion (Control) Joint: Galvanized or aluminum-coated steel sheet or rolled zinc control joint with 1/2 inch to 3/4 inch grounds for drywall finishes. Staple or screw grounds to panel face.
g. Curved-Edge Cornerbead: With notched or flexible flanges.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use joint setting compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use joint setting compound.
3. Fill Coat: For second coat, use joint setting compound.
4. Finish Coat: For third coat, use drying-type compound.

D. Joint Compound for Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

E. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot-grouting hollow metal door frames.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Provide sound attenuation blankets free of formaldehyde.

E. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."

F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine weathertight building enclosure, with Installer present, and verify that delivery, storage, and installation of gypsum panel products will not be affected by exposure to moisture beyond limits recommended by manufacturer.

C. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

C. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

D. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

F. Form control and expansion joints with space between edges of adjoining gypsum panels.

G. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.

H. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

I. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

K. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

L. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.

1. Space screws a maximum of 12 inches o.c. for vertical applications.

M. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints at locations indicated on Drawings, or, if not shown, according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.
2. LC-Bead: Use at exposed panel edges.
3. L-Bead: Use where indicated.
4. U-Bead: Use at exposed panel edges.
5. Curved-Edge Cornerbead: Use at curved openings.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:

1. Level 0: This level of finish shall be used in temporary construction only. No taping, finishing, or accessories required unless indicated or specified as in dust proof partitions.
2. Level 1: This level shall be used in ceiling plenum areas and concealed areas unless a higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies. Embed tape at joints.
3. Level 2: This level of finish shall be used where water resistant gypsum backing board is used as a substrate for tile. Embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges where indicated.
4. Level 3: This level of finish shall be used in areas to receive heavy textured, thick (1/8 inch or greater) wall coverings and where indicated. Embed tape and apply separate first and finish coats of joint compound to tape, fasteners, and trim flanges.
5. Level 4: This level of finish shall be used for areas to receive smooth paint finish. Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces.

    a. Tape joints require joint compound and feathering of joint to a minimum of 12 inches each side of joint.
    b. Tape joints that are visible through finished walls are not acceptable.
    c. Outside corners shall be feathered out a minimum of 12 inches each side of corner.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.6 FIELD QUALITY CONTROL

A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:

    a. Installation of 80 percent of lighting fixtures, powered for operation.
    b. Installation, insulation, and leak and pressure testing of water piping systems.
    c. Installation of air-duct systems.
    d. Installation of air devices.
    e. Installation of mechanical system control-air tubing.
    f. Installation of ceiling support framing.
    g. Installation of through-penetration firestopping and fire-resistant joint sealants, with identification labels.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glazed wall tile.

B. Related Requirements:

1. Section 092900 "Gypsum Board" for glass-mat, water-resistant backer board.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples: For tile, grout, and accessories involving color selection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of product.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of wall tile installation.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

2.2 PRODUCTS, GENERAL

A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

2.3 TILE PRODUCTS **(AA-WT-3** thru **AA-WT-6)** - AA-WT-1 and AA-WT-2 not used.

A. Tile Type: Glass wall tile.

1. Products: As indicated on Finish Legend.
2. Module Size: 2 by 8 inches.
3. Face Size Variation: Rectified.
4. Face: Plain with cushion edges.
5. Tile Color: As indicated on Finish Legend.
6. Grout Color: As indicated on Finish Legend.

2.4 SETTING MATERIALS

A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.

1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.5 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

2.6 MISCELLANEOUS MATERIALS

A. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.7 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CERAMIC TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

F. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Wall Tile: 1/8 inch.

G. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

3.3 ADJUSTING AND CLEANING

A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.
2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.4 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls.

B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.5 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Wall Installations, Wood or Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.

a. Ceramic Tile Type: Glass wall tile.
b. Thinset Mortar: Modified dry-set mortar.
c. Grout: Water-cleanable epoxy grout.

END OF SECTION 093013

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.

C. Delegated-Design Submittal: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.
    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:
    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.

g. Perimeter moldings.

7. Minimum Drawing Scale: 1/8 inch = 1 foot.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 5 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 50 or less.

B. Delegated Design: Engage a qualified professional engineer to design seismic restraints for ceiling systems.

C. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7 and CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 0-2."

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

B. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.3 ACOUSTICAL PANELS

A. Acoustical Panel **(APC-1** and **APC-2)**:

1. Basis of Design: As indicated on Finish Legend.
2. Color: White.
3. Edge/Joint Detail: Beveled tegular.
4. Noise Reduction Coefficient (NRC): Not less than 0.70.
5. Modular Size: As indicated on Finish Legend.

2.4 METAL SUSPENSION SYSTEM

A. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.

B. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 9/16-inch-wide metal caps on flanges.

1. Basis of Design: As indicated on Finish Legend.
2. Structural Classification: Intermediate-duty system.
3. End Condition of Cross Runners: Override (stepped) type.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch-diameter wire.

C. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

D. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

F. Single Tee Adapter Clip: Manufacturer's standard. Provide with running bond ceilings.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Provide edge moldings and trim from the manufacturer of suspension system.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.

1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.7 AUXILIARY MATERIALS

A. Acoustical Sealant: As specified in Section 079200 "Joint Sealants."

B. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

A. Install acoustical panel ceilings according to ASTM C 636/C 636M, seismic design requirements, and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

11. Install hanger wire as specified above within 6 inches of each corner of the grid at every light, air diffuser, air return grill, and other equipment items which are installed within or penetrate the ceiling system.

C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels in a basket-weave pattern.
2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
6. Install hold-down clips at entrances and in areas required by authorities having jurisdiction; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.
7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.
8. Install seismic clips as required.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For each type of product indicated, in manufacturer's standard-size Samples, of each resilient product color, texture, and pattern required.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain resilient stair treads and accessories, and rubber floor tile by a single manufacturer.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE **(AA-RB-1, UA-RB-1,** and **DL-RB-1)**

A. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TS (vulcanized thermoset rubber) or Type TP (rubber, thermoplastic).
2. Manufacturing Method: Group I (solid, homogenous).
3. Style: Cove (base with toe).
4. Minimum Thickness: 0.125 inch.
5. Height: 4 inches, unless otherwise indicated.
6. Lengths: Coils in manufacturer's standard length, but not less than 96 feet.
7. Outside and Inside Corners: Preformed.
8. Colors: As indicated on Finish Legend.

2.2 RESILIENT MOLDING ACCESSORY

A. Description:

1. Reducer strips.
2. Transition strips.

B. Material: Rubber or vinyl.

C. Profile and Dimensions: As selected by Architect.

D. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096520 - RESILIENT PLANK FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Luxury vinyl floor planks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include floor plank layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples: Full-size units of each color and pattern required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.7 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive flooring.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Close spaces to traffic during flooring installation and for 48 hours after flooring installation.

D. Install flooring after other finishing operations, including painting, have been completed.

E. Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test.

PART 2 - PRODUCTS

2.1 LUXURY VINYL FLOOR PLANKS **(AA-LVT-1** and **DL-LVT-1)**

A. Luxury Vinyl Planks: Products complying with ASTM F 1700, Class III - printed film vinyl, Type B - embossed surface.

1. Product: As indicated on Finish Legend.
2. Color and Pattern: As indicated on Finish Legend.
3. Size: 9 by 59 inches.
4. Wear Layer Thickness: 20 mil.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit flooring and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by floor covering manufacturer. Proceed with installation only after substrates pass testing.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor planks until they are same temperature as space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 FLOOR INSTALLATION

A. Comply with manufacturer's written instructions for installing floor planks.

B. Apply leveling compound at transitions from tile to resilient flooring and feather out over two feet.

C. Lay out floor planks from center marks established with principal walls, discounting minor offsets, so planks at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half plank at perimeter.

1. Lay planks square with room axis.

D. Match floor planks for color and pattern by selecting planks from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed planks.

1. Lay planks with grain running in one direction.

E. Scribe, cut, and fit floor planks to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

F. Extend floor planks into toe spaces, door reveals, closets, and similar openings. Extend floor planks to center of door openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor planks as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

H. Adhere floor planks to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Hand roll resilient flooring according to manufacturer's written instructions.

J. Cleaning and Protection: Comply with manufacturer's written instructions for cleaning and protection of flooring.

END OF SECTION 096520

SECTION 096536 - STATIC-CONTROL RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Static-dissipative, vinyl composition floor tile.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include floor covering layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.
2. Submit grounding diagram showing location of grounding strips and connections.

C. Samples: For each type of static-control resilient flooring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of static-control resilient flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor covering installation indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store static-control resilient flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer but not less than 50 deg F or more than 90 deg F.

1. Floor Tile: Store on flat surfaces.

1.8 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor coverings during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during, and 48 hours after, floor covering installation.

D. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Static-Dissipative Properties: Provide floor coverings with static-control properties indicated as determined by testing identical products per test method indicated by an independent testing and inspecting agency.

1. Electrical Resistance: Test per ESD-STM-7.1.

a. Average greater than 1 megohm and less than or equal to 1000 megohms when test specimens are tested surface to ground.
b. Average no less than 1 megohm and less than or equal to 1000 megohms when installed floor coverings are tested surface to ground.

2. Static Generation: Less than 300 V when tested per AATCC-134 at 20 percent relative humidity with conductive footwear.
3. Static Decay: 5000 to 0 V in less than 0.25 seconds when tested per FED-STD-101C/4046.1.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 STATIC-DISSIPATIVE RESILIENT FLOOR COVERINGS **(AA-SDT-1, UA-SDT-1,** and **DL-SDT-1)**

A. Static-Dissipative, Vinyl Composition Floor Tile: ASTM F 1066 (vinyl composition floor tile, nonasbestos formulated), Class 2 (through-pattern tile).

1. Product: As indicated on Finish Legend.
2. Thickness: 0.125 inch.
3. Size: 12 by 12 inches.
4. Color: As indicated on Finish Legend.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Static-Control Adhesive: Provided or approved by manufacturer; type that maintains electrical continuity of floor covering system to ground connection.

C. Grounding Strips: Provided or approved by manufacturer; type and size that maintains electrical continuity of floor covering system to ground connection.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings and electrical continuity of floor covering systems.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
4. Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor coverings until they are same temperature as space where they are to be installed.

1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.2 INSTALLATION, GENERAL

A. Install static-control resilient flooring according to manufacturer's written instructions.

B. Embed grounding strips in static-control adhesive. Extend grounding strips beyond perimeter of static-control resilient floor covering surfaces to ground connections.

C. Scribe, cut, and fit floor coverings to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings. Extend floor covering to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.

F. Install floor coverings on covers for telephone and electrical ducts, and similar items in installation areas. Maintain overall continuity of color and pattern with pieces of floor coverings installed on covers. Tightly adhere floor covering edges to substrates that abut covers and to cover perimeters.

G. Adhere floor coverings to substrates using a full spread of static-control adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 FLOOR-TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half floor tile at perimeter.

1. Lay floor tiles square with room axis.

C. Match floor tiles for color and pattern by selecting floor tiles from cartons in same sequence as manufactured and packaged if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

3.4 FIELD QUALITY CONTROL

A. Testing: Owner may engage a qualified testing agency to test electrical resistance of static-control resilient floor covering systems for compliance with requirements.

1. Arrange for testing after installation static-control adhesives have fully cured and floor covering systems have stabilized to ambient conditions and after ground connections are completed.

B. Static-control resilient flooring will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of flooring.

B. Perform the following operations immediately after completing floor covering installation:

1. Remove static-control adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor coverings from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

1. Do not wax static-control resilient flooring.

D. Cover static-control resilient flooring until Substantial Completion.

END OF SECTION 096536

SECTION 096623 - RESINOUS MATRIX TERRAZZO FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thin-set, epoxy-resin terrazzo flooring and base.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealants installed with terrazzo.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details, and attachments to other work. Show layout of the following:

1. Divider strips.
2. Control-joint strips.
3. Terrazzo patterns.

C. Samples: For each type, material, color, and pattern of terrazzo and accessory required showing the full range of color, texture, and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes, and proportions. Prepare Samples of same thickness and from same material to be used for the Work, in size indicated below:

1. Terrazzo: 6-inch- square Samples.
2. Accessories: 6-inch- long Samples of each exposed strip item required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. Installer: Provide proof of NTMA membership, documentation of experience, and resumes of key personnel.
2. Manufacturer: Provide proof of NTMA membership, documentation of experience, and written approval of installer.

B. Material Certificates: For each type of terrazzo material or product, from manufacturer.

C. Installer Certificates: Signed by manufacturers certifying that installers comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terrazzo to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Engage an installer who is a contractor member of NTMA.
2. Engage an installer who is certified in writing by terrazzo manufacturer as qualified to install manufacturer's products.
3. Engage an installer who has at least 5 years of satisfactory experience in installation of epoxy terrazzo.
4. Furnish experience resumes of key personnel including supervisors and technicians to be utilized on project, including project manager, field supervisor, head mechanic for placing and lead grinder.
5. Furnish documentation of at least 3 epoxy terrazzo projects of similar scope and using same material as specified for this project, that installer has installed during the past 2 years, including the following:

    a. Project name.
    b. Square footage of terrazzo installed.
    c. Lineal footage of base.
    d. Address of facility with contact name and phone number.
    e. Contact name, address and phone number of general contractor or construction manager.
    f. Field experience resumes of key project personnel including supervisors and technicians.

B. Manufacturer Qualifications:

1. Manufacturer with active membership in NTMA.
2. Manufacturer with a minimum of five projects within the last five years using products similar to those being submitted for this project and of the same scope, complexity, and at least 75 percent of the square footage.
3. Manufacturer with history of providing primary epoxy materials to a minimum of five NTMA installers in good standing for a minimum of 10 years.

C. Source Limitations: Obtain primary terrazzo materials from single source from single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

D. Source Limitations for Marble Chips: Obtain each color, grade, type, and variety of granular materials from single source with resources to provide materials of consistent quality in appearance and physical properties.

E. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

F. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockups for terrazzo including accessories.

    a. Size: Minimum 100 sq. ft. of typical poured-in-place flooring and base condition for each color and pattern in locations directed by Architect.

2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to terrazzo including, but not limited to, the following:

a. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
b. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
c. Review special terrazzo designs and patterns.
d. Review dust control procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in supplier's original wrappings and containers, labeled with source's or manufacturer's name, material or product brand name, and lot number if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting terrazzo installation.

B. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

C. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

D. Control and collect water and dust produced by grinding operations. Protect adjacent construction from detrimental effects of grinding operations.

1. Provide dustproof partitions and temporary enclosures to limit dust migration and to isolate areas from noise.

1.9 WARRANTY

A. Labor and Material Warranty: Submit a written warranty, signed by both installer and manufacturer for epoxy terrazzo flooring system. Warranty includes loss of bond and damage due to normal wear and tear.

1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.2 EPOXY-RESIN TERRAZZO

A. Epoxy-Resin Terrazzo **(TR-1, TR-2** and **TR-3)**: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.

1. Basis of Design: As indicated on Finish Legend.

2. Thickness: 3/8-inch nominal.
3. Base: Coved.
4. Formulated Mix Color and Pattern: As indicated on Finish Legend.

B. Materials:

1. Moisture-Vapor-Emission-Control Membrane: Two-component, high-solids, high-density, low-odor, epoxy-based membrane-forming product produced by epoxy terrazzo manufacturer that reduces moisture emission from concrete substrate to not more than 3 lb of water/1000 sq. ft. in 24 hours.
2. Flexible Reinforcing Membrane: Manufacturer's resinous membrane for substrate-crack preparation and reflective-crack reduction.
    a. Thickness: 40 mils.
3. Primer: Manufacturer's product recommended for substrate and use indicated.
4. Epoxy-Resin Matrix: Manufacturer's standard recommended for use indicated and in color required for mix indicated.
    a. Physical Properties without Aggregates:
        1) Hardness: 60 to 85 per ASTM D 2240, Shore D.
        2) Minimum Tensile Strength: 3000 psi per ASTM D 638 for a 2-inch specimen made using a "C" die per ASTM D 412.
        3) Minimum Compressive Strength: 10,000 psi per ASTM D 695, Specimen B cylinder.
        4) Chemical Resistance: No deleterious effects after seven-day immersion at room temperature per ASTM D 1308.
    b. Physical Properties with Aggregates: For resin blended with Georgia white marble, ground, grouted, and cured per requirements in NTMA's "Terrazzo Specifications and Design Guide"; comply with the following:
        1) Flammability: Self-extinguishing, maximum extent of burning 1/4 inch per ASTM D 635.
        2) Thermal Coefficient of Linear Expansion: 0.0025 inch/inch per deg F for temperature range of minus 12 to plus 140 deg F per ASTM D 696.
5. Marble Chips: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.
    a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C 131.
    b. 24-Hour Absorption Rate: Less than 0.75 percent.
    c. Dust Content: Less than 1.0 percent by weight.
6. Finishing Grout: Resin based.

2.3 STRIP MATERIALS

A. Heavy-Top Divider Strips **(MT-1)**: L-type angle in depth required for topping thickness indicated.

1. Bottom-Section Material: Matching top-section material.
2. Top-Section Material: White zinc.
3. Top-Section Width: As indicated on Drawings.

B. Heavy-Top Transition Strips **(MT-2)**: L-type angle in depth required for topping thickness indicated.

1. Bottom-Section Material: Matching top-section material.
2. Top-Section Material: White zinc.
3. Top-Section Width: As indicated on Drawings.

C. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.

D. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:

1. Base-bead strips for exposed top edge of terrazzo base.
2. Edge-bead strips for exposed edges of terrazzo.

2.4 MISCELLANEOUS ACCESSORIES

A. Anchoring Devices:

1. Strips: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and required for secure attachment to substrate.

B. Patching and Fill Material: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

C. Joint Compound: Terrazzo manufacturer's resinous product approved and recommended by manufacturer for application indicated.

D. Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by sealer manufacturer for use on terrazzo type indicated.

E. Sealer: Slip- and stain-resistant, penetrating-type acrylic, water-based sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's "Terrazzo Specifications and Design Guide" for terrazzo type indicated.

1. Surface Friction: Not less than 0.6 according to ASTM D 2047.
2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions, including levelness tolerances, have been corrected.

3.2 PREPARATION

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

B. Concrete Slabs:

1. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with terrazzo.

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.

b. Repair damaged and deteriorated concrete according to terrazzo manufacturer's written recommendations.
c. Use patching and fill material to fill holes and depressions in substrates according to terrazzo manufacturer's written instructions.

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests indicated below.

a. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

D. Moisture-Vapor-Emission-Control Membrane: Install according to manufacturer's written instructions.

1. Install concrete substrates that fail preinstallation moisture testing.

E. Protect other work from water and dust generated by grinding operations. Control water and dust to comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit water damage and dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

3.3 EPOXY-RESIN TERRAZZO INSTALLATION

A. Comply with NTMA's written recommendations for terrazzo and accessory installation.

B. Place, rough grind, grout, cure grout, fine grind, and finish terrazzo according to manufacturer's written instructions and NTMA's "Terrazzo Specifications and Design Guide."

C. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet; noncumulative.

D. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control-joint strips.

E. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

F. Flexible Reinforcing Membrane:

1. Prepare and prefill substrate cracks with membrane material.
2. Install membrane to produce full substrate coverage in areas to receive terrazzo.
3. Prepare membrane according to manufacturer's written instructions before applying substrate primer.

G. Primer: Apply to terrazzo substrates according to manufacturer's written instructions.

H. Strip Materials:

1. Divider and Control-Joint Strips:

a. Locate divider strips in locations indicated.
b. Install control-joint strips back to back directly above concrete-slab control joints.
c. Install control-joint strips with 1/4-inch gap between strips, and install sealant in gap.
d. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory and Transition Strips: Install as required to provide a complete installation.

I. Placing Terrazzo:

1. Mix epoxy matrix with chips and fillers in ratios directed by resin systems.
2. Trowel-apply terrazzo mixture over epoxy primer to provide a dense flat surface to top of divider strips. Allow to cure per manufacturer's recommendations before rough grinding.

J. Rough Grinding: Grind with 40 to 80 grit and 150 diamond matrix stones until all terrazzo strips and marble chips are uniformly exposed.

K. Grouting:

1. Cleanse floor with clean water and rinse.
2. Remove excess rinse water by wet vacuum, dry, and fill voids with resin systems epoxy matrix or clear resin.
3. Allow grout to cure.
4. Remove excess grout with 150 grit diamonds and then follow with 200 grit diamonds.

L. Fine Grinding/Polishing: Grinding with 3000-grit diamonds until all grout is removed from surface. Repeat rough grinding, grout coat, and polishing if large terrazzo chip voids exist after initial polishing. Produce surface with a minimum of 70% aggregate exposure.

3.4 REPAIR

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.5 CLEANING AND PROTECTION

A. Cleaning:

1. Remove grinding dust from installation and adjacent areas.
2. Wash surfaces with cleaner according to NTMA's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

C. Protection: Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensures that terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION 096623

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes carpet tile and installation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Pattern of installation.
4. Pattern type, location, and direction.
5. Type, color, and location of insets and borders.
6. Type, color, and location of edge, transition, and other accessory strips.
7. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.

B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:

a. Review delivery, storage, and handling procedures.
b. Review ambient conditions and ventilation procedures.
c. Review subfloor preparation procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.8 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

1.10 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 2 percent of amount installed for each type indicated, but not less than 10 sq. yd.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Carpet Tile **(CPT-1, AA-CPT-1, AA-CPT-2, UA-CPT-1, DL-CPT-1)**:

1. Basis of Design: As indicated on Finish Legend.
2. Color: As indicated on Finish Legend.
3. Backing System: Manufacturer's standard.
4. Size: As indicated on Finish Legend.
5. Applied Soil-Resistance Treatment: Manufacturer's standard material.
6. Antimicrobial Treatment: Manufacturer's standard material.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Low VOC, Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Maintain pile direction patterns as recommended in writing by carpet tile manufacturer.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097000 - WALL FINISHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pre-engineered wall system including wall panels, mounting extrusions, bases and frame. Wall system comes “ready to install” with fasteners, adhesives, and other materials required for a complete assembly. Fasteners shall be concealed type.

1.2 SUBMITTALS

A. Submit manufacturer’s shop drawings, installation drawings, installation instructions and maintenance instructions.

B. Samples: Submit samples for all specified material finishes.

C. Mock-Up: Submit mock-up of wall system no less than 12” x 12”.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Minimum 10 years experience in the manufacture of architectural surface materials.
2. Minimum 10 years experience in the fabrication of wall systems.

B. Installer Qualifications:

1. Minimum three years experience in the installation of wall systems.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to installation site in manufacturer’s original packaging. Handle products in accordance with manufacturer’s instructions. Store in dry, secure location, protected against direct sunlight and excessive heat. Protect finished surfaces with strippable film.

1.5 WARRANTY

A. Warranty: Provide manufacturer’s standard warranty against defects in materials and workmanship.

1. Warranty Period: One year from Date of Substantial Completion.

PART 2 - PRODUCT

2.2 WALL PANELS **(WPS-1 and WPS-2)**

A. General:

1. Provide interlocking grid panel system with inset panels mounted to extruded aluminum frames on structural backer of 3/4″ fire-rated OSB or plywood.
2. Panel Configuration: As indicated on Finish Legend. See drawings for panel layout and reveal spacing.

3. Frames: Extruded aluminum.

B. Inset Materials:

1. Stainless Steel Panels:

a. Product: As indicated on Finish Legend.
b. Material: Stainless Steel.
c. Finish: Sandstone.
d. Pattern: Diamond.
e. Treatment: Provide clear protective treatment to increase fingerprint resistance and maintenance ease of stainless steel.

2. Laminated Glass Panels:

a. Product: As indicated on Finish Legend.
b. Material: Clear, tempered glass with interlayer.

1) Glass Thickness: 6.0 mm for each lite.
2) Interlayer Thickness: 2.0 mm.

c. Configuration: Reflect.
d. Finish: Opalex.
e. Color: As indicated on Finish Legend.

C. Base: Stainless steel panels.

1. Finish: As selected by Architect from manufacturer's full range.

D. Panel Frames and Outside Corner Extrusions:

1. Material: Extruded, anodized aluminum
2. Finish: As selected by Architect from manufacturer's full range.

E. Reveals:

1. Material: Extruded, anodized aluminum.
2. Finish: Black

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect wall finishes, fixtures and equipment from damage caused by work of this Section.

3.2 INSTALLATION

A. Install in accordance with wall system manufacturer’s instructions.

3.4 CLEANING AND PROTECTION

A. Remove strippable film. Clean exposed surfaces in accordance with manufacturer’s instructions.

B. Protect exposed surfaces from damage by subsequent construction.

END OF SECTION 097000

SECTION 099113 - EXTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following exterior substrates:

1. Galvanized metal.

1.3 DEFINITIONS

A. Gloss Level: According to ASTM D 523.

1. Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees,
2. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
4. Gloss Level 5: 35 to 70 units at 60 degrees.
5. Gloss Level 6: 70 to 85 units at 60 degrees.
6. Gloss Level 7: More than 85 units at 60 degrees.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer’s certification that top coat is compatible with shop primer.

1.6 CLOSEOUT SUBMITTALS

A. Mix Formula: For each color provided.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.8 QUALITY ASSURANCE

A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system.

a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Final approval of color selections will be based on mockups.

a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.10 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Painting Schedule: Refer to end of Part 3 of this Section for listing of applications for each product.

B. Products, General: Refer to Finish Legend on Drawings for specific products. Subject to compliance with requirements, provide the products indicated or comparable products from one of the listed manufacturers for each substrate.

2.2 PAINT, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As selected by Architect from manufacturer's full range.

2.3 PAINT ADDITIVES

A. Mildewcide Additive: Manufacturer's recommended broad-spectrum fungicide additive compatible with paint. Mix in accordance with manufacturer's written instructions.

1. Basis of Design: CFI Products; MX-3

2.4 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:

1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

C. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

E. Provide field-applied topcoat to shop-primed surfaces.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.

B. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 EXTERIOR PAINTING SCHEDULE

A. Galvanized-Metal Substrates:

1. Water-Based Light Industrial Direct-to-Metal Coating System:

a. Prime Coat: Shop primed.
b. Intermediate Coat: Light industrial coating matching topcoat.
c. Topcoat: Light industrial coating, exterior, water based, direct-to-metal.

END OF SECTION 099113

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Galvanized metal.
3. Steel.
4. Wood.
5. Gypsum board.

1.3 DEFINITIONS

A. Gloss Levels: ASTM D 523

1. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees.
2. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees.
3. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees.
4. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees.
5. Gloss Level 5: 35 to 70 units at 60 degrees.
6. Gloss Level 6: 70 to 85 units at 60 degrees.
7. Gloss Level 7: More than 85 units at 60 degrees.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

C. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.5 CLOSEOUT SUBMITTALS

A. Mix Formula: For each color provided.

1.6 QUALITY ASSURANCE

A. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft.
b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.8 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 2 percent, but not less than 1 gal. of each material and color applied.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Painting Schedule: Refer to end of Part 3 of this Section for listing of applications for each product.

B. Products, General **(P-1** thru **P-4, AA-P-1** thru **AA-P-6, UA-P-1A** thru **UA-P-4,** and **DL-P-1** thru **DL-P-3)**: Refer to Finish Legend on Drawings for specific products. Subject to compliance with requirements, provide the products indicated or comparable products from one of the listed manufacturers for each substrate.

C. Colors: As indicated on Finish Legend.

D. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Wood: 15 percent.
3. Gypsum Board: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Application of coating constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Apply field primer to unfinished shop primed surfaces.

E. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

1. Galvanized-metal substrates should not be chromate passivated (commercially known as "bonderized") if primers are field applied. If galvanized metal is chromate passivated, consult manufacturers for appropriate primers.

G. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

H. Shop Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

I. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

J. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Backrolling: Back roll all spray applications on walls and ceilings to allow for touch up.

F. Apply primers and finish coats in accordance with manufacturer's recommended dry-film thickness, square foot per gallon, and mil thickness per coat. Do not add solvent or thinner to paint and coating products.

G. Allow adequate curing time before handling and before applying subsequent coats. Low VOC and water-based paint systems require longer drying times. Comply with manufacturer's written instructions. Protect in accordance with "Cleaning and Protection" Article below.

H. Painting Mechanical and Electrical Work: Paint same color as the adjoining substrate items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

    a. Uninsulated metal piping.
    b. Uninsulated plastic piping.
    c. Pipe hangers and supports.
    d. Tanks that do not have factory-applied final finishes. Should be prefinished.
    e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
    f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

    a. Switchgear.
    b. Panelboards.
    c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

3.4 MARKING AND IDENTIFICATION

A. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently indentified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
2. Be repeated at intervals not exceeding 20 feet measured horizontally along both sides of the wall or partition; and
3. Include red lettering not less than 2 inches in height, incorporating the suggested wording: "_X_ HOUR FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording approved or required by Authority Having Jurisdiction (AHJ). Replace “X” with the appropriate designated hourly rating.
4. Apply a minimum one-inch wide bright red horizontal line, both sides of wall, interrupted for approved text, at the required interval.
5. Refer to the Drawings for locations of walls and for applicable types and ratings.

3.5 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.6 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.7 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Clear Sealer System:

a. First Coat: Interior/exterior clear concrete floor sealer (water based).
b. Topcoat: Interior/exterior clear concrete floor sealer (water based).

B. Galvanized-Metal Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Waterborne galvanized-metal primer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).

C. Steel Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Shop-applied primer or rust-inhibitive primer (water based).
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).

D. Wood Substrates: Including painted plywood.

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex (semigloss).

E. Gypsum Board Substrates:

1. Institutional Low-Odor/VOC Latex System:

a. Prime Coat: Institutional low-odor/VOC interior latex primer/sealer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat for Ceilings: Institutional low-odor/VOC interior latex (flat).
d. Topcoat for Other Locations: Institutional low-odor/VOC interior latex (eggshell).

END OF SECTION 099123

SECTION 101423 - ROOM-IDENTIFICATION SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Room-identification signs, as required by code.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design," the ABA standards of the Federal agency having jurisdiction, and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

A. Manufacturers of Panel Signs: Subject to compliance with requirements, provide products by one of the following:

1. APCO Graphics, Inc.
2. ASI Sign Systems, Inc.
3. Avalis Wayfinding Solutions Inc.
4. Best Manufacturing Company
5. Gemini Incorporated
6. Innerface Sign Systems, Inc.
7. InPro Corporation
8. Mohawk Sign Systems
9. Poblocki Sign Company
10. Supersine Company

B. General:

1. Provide signs as required by code, including but not limited to, toilet rooms, stairs, elevators, exits, electrical rooms, and assembly spaces.
2. Provide graphics and Braille as required by code.
3. Fabricate panel signs to comply with the requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes and details of construction. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed condition within a tolerance of plus or minus 1/16 inch measured diagonally.

C. Unframed Panel Signs: Fabricate unframed panel signs with edges mechanically and smoothly finished to conform with the following requirements:

1. Edge Condition: Beveled.
2. Corner Condition: Provide corners rounded to 1/2-inch radius.
3. Signs: Nominal 3/16-inch-thick, plastic or phenolic, with the following:
    a. Raised characters, 1/32 inch minimum, at least 5/8-inch-high but not higher than 2 inches;
    b. Raised numbers, 1/32 inch minimum, at least 1-inch high numbers;
    c. Raised Braille, 1/32 inch minimum, Grade 2;
    d. Signs shall be etched and have raised integral symbols and letters. Applied symbols and letters are not acceptable.
    e. Each room sign shall list the room number and a room identification name in both Braille and in the characters and numbers described above.
4. Character Font: As selected by Architect.
5. Exterior Signs: Provide fiberglass units for exterior applications.
6. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.
    a. Color: Color matching sign or black. Confirm final color selection with Architect.
7. Copy for each sign shall be provided during the Construction Phase of the project.
8. Handicapped Symbols: Provide one combination handicapped symbol, male and female caricatures, and room identification sign for every room where handicapped facilities are provided, such as toilet rooms.
9. Color: As selected by Architect from manufacturer's full range.
10. Mounting Height Above Floor: 48 inches minimum above floor measure to baseline of lowest raised character and 60 inches maximum above floor measured to baseline of highest raised character.

2.3 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
2. Exposed Metal-Fastener Components, General:

a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.

3. Sign Mounting Fasteners:

a. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045-inch-thick, with adhesive on both sides.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:

1. Interior Signage: Manufacturer's standard two-face tape and silicone-adhesive mounting, unless otherwise indicated.

a. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
b. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

2. Exterior Signage: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Install signage in accordance with approved shop drawings, ADA requirements, and at locations indicated on the Drawings and in conformance with manufacturer’s instructions using only approved materials and methods.

END OF SECTION 101423

SECTION 102600 - WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Corner guards.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each wall protection unit.

B. Shop Drawings: For each wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

C. Samples: For each type of wall protection unit indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Store in compliance with manufacturer's written recommendations.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

B. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with wall protection units by field measurements before fabrication and indicate measurements on shop drawings.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of plastic and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arden Architectural Specialties, Inc.
2. Balco, Inc.
3. Construction Specialties, Inc.
4. IPC Door and Wall Protection Systems; Division of InPro Corporation
5. Korogard Wall Protection Systems; a division of RJF International Corporation
6. Pawling Corporation
7. Tepromark International, Inc.

2.2 CORNER GUARDS **(AA-CG-1, UA-CG-1,** and **DL-CG-1)**

A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Material: Stainless-steel sheet, Type 304.

a. Thickness: 16 gauge.
b. Finish: Directional satin, No. 4.

2. Wing Size: As indicated on Finish Legend.
3. Corner Radius: 1/8 inch.
4. Mounting: Adhesive as recommended by wall protection manufacturer.

2.3 FABRICATION

A. Fabricate wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.

B. Examine walls to which wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment.

1. For wall protection units attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

1. Install wall protection units in locations and at mounting heights indicated on Drawings.

3.4 CLEANING

A. Immediately after completion of installation, clean wall protection units using manufacturer's recommended cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 104400 - FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Portable fire extinguishers.
2. Fire protection cabinets for portable fire extinguishers.
3. Wall mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.

1. Fire Extinguishers: Include rating and classification.
2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.
2. Provide fire extinguishers in elevator mechanical/control rooms that comply with North Carolina Department of Labor requirements.

C. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.6 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

C. Provide fire rated cabinets where indicated to be installed in fire rated walls.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amerex Corporation.
2. Ansul Incorporated; Tyco International Ltd.
3. Badger Fire Protection; a Kidde company.
4. J.L. Industries, Inc.
5. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
6. Larsen's Manufacturing Company.
7. Potter-Roemer; Div. of Smith Industries, Inc.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

B. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

2.3 PORTABLE FIRE EXTINGUISHERS

A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.

B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb nominal capacity, in enameled-steel container.

2.4 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

B. Cabinet Construction: Nonrated and fire rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch thick, cold-rolled steel sheet lined with minimum 5/8-inch thick, fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Steel sheet.

G. Door Style: Vertical duo panel with frame.

H. Door Glazing: Acrylic sheet, clear transparent.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch.
2. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
3. Provide manufacturer's standard hinge permitting door to open 180 degrees.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
    a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
        1) Location: Applied to cabinet door.
        2) Application Process: Decals or Pressure-sensitive vinyl letters.
        3) Lettering Color: Red.
        4) Orientation: Vertical.

K. Finishes: Manufacturer's standard baked enamel or powder coat finish.

L. Fabrication:

1. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
    a. Weld joints and grind smooth.
    b. Provide factory-drilled mounting holes.
2. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
    a. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
    b. Miter and weld perimeter door frames.
3. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 WALL MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning".

B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets are to be installed.

B. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire-protection specialties.

B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
2. Fasten mounting brackets to structure and cabinets, square and plumb.
3. Fasten cabinets to structure, square and plumb.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinets and doors damaged during installation.

C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

D. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104400

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard metal lockers, single point positive latch.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: For metal lockers. Include plans, elevations, sections, details, and attachments to other work.

1. Show locker trim and accessories.
2. Include locker identification system and numbering sequence.

C. Samples: For units with factory-applied color finishes.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain metal lockers and accessories from single source from single manufacturer.

C. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities".

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

B. Protect lockers from damage during delivery, handling, storage, and installation.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.

B. Steel Tube: ASTM A 500, cold rolled.

C. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

D. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.2 STANDARD METAL LOCKERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Art Metal Products
2. Bradley Corporation
3. Foreman Locker Systems
4. Hadrian Manufacturing, Inc.
5. List Industries Inc.
6. Lyon Workspace Products, LLC
7. Penco Products, Inc.
8. Republic Storage Systems Company

B. Locker Arrangement and Size: Double tier, 12 inches wide by 15 inches deep.

C. Material: Cold-rolled steel sheet.

D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet as follows:

1. Fabricate backs and sides of minimum 24-gauge steel, with double-flanged connections extending full height.
2. Form tops and bottoms of not less than 24 gauge steel, with flanged edges.

E. Frames: Channel formed; fabricated from 16 gauge steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.

1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

F. Doors: One piece; fabricated from 0.060-inch nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.

1. Door Style: Vented panel as follows:

a. Louvered Vents: No fewer than three louver openings at top and bottom for double-tier lockers.

G. Hinges: Provide knuckle or continuous hinges, welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Knuckle Hinges: Steel, full loop, five or seven knuckles, tight pin; minimum 2 inches high. Provide no fewer than three hinges for each door more than 42 inches high.
2. Continuous Hinges: Manufacturer's standard, steel, full height.

H. Recessed Door Handle and Single Point Positive Latch: Stainless-steel cup with integral door pull, recessed so locking device does not protrude beyond face of door; pry and vandal resistant.

1. Single-Point Positive Latching: Nonmoving latch hook with steel padlock loop that projects through recessed cup and is finished to match metal locker body.

a. Latch Hook: Equip each door with one latch hook, fabricated from 0.105-inch nominal-thickness steel sheet; welded midway up full-height door strike; with resilient silencer.
b. Positive Latching: Provide manufacturer’s standard spring-loaded positive latch.
c. Handicap Lockers: Provide manufacturer’s standard ADA compliant handle.

I. Combination Padlocks: Provided by others.

J. Digital Keypad Locks for Handicap Lockers: Battery-powered electronic keypad with reprogrammable manager and owner codes that override access. Three consecutive incorrect code entries shall disable lock for three minutes.

1. Designed for shared or temporary access by multiple users, with user-defined code to lock and unlock. Provide LED indicator to show when lock is in use.

K. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:

1. Double-Tier Units: Two single-prong wall hooks.

L. Accessories:

1. Continuous Zee Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch nominal thickness steel sheet.

a. Height: 4 inches.

2. Filler Panels: Fabricated from 24-gauge steel sheet.
3. Boxed End Panels: Fabricated from 24-gauge steel sheet.
4. Continuous Sloped Tops: 16-gauge steel sheet, approximately 25-degree pitch, factory finished to match lockers. Provide closure ends.

5. Number Plates: Manufacturer's standard etched, embossed, or stamped, aluminum number plates with numerals at least 3/8 inch high.
6. ADA Decal: A decal with the international symbol of accessibility shall be applied to the face of the locker door.

M. Finish: Powder coat.

1. Color: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for nominal assembly at Project site.

D. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches above the floor.
2. Where hooks or additional shelves are provided, locate no higher than 48 inches above the floor.

E. Hooks: Manufacturer's standard ball-pointed type, aluminum or steel; zinc plated.

F. Identification Plates: Attach plates to each locker door, near top, centered, with a minimum of two aluminum rivets.

G. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

H. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping top corner fillers, mitered.

I. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

J. Boxed End Panels: Fabricated with 1-inch wide edge dimension, and designed for concealing fasteners and holes at exposed ends of nonrecessed metal lockers; finished to match lockers.

2.4 STEEL FINISHES

A. Factory finish steel surfaces and accessories except stainless-steel and chrome-plated surfaces.

B. Powder-Coat Finish: Immediately after cleaning and pretreating, electrostatically apply manufacturer's standard, baked-polymer, thermosetting powder finish. Comply with resin manufacturer's written instructions for application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top of lockers and to floor.

B. Knocked-Down Metal Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
4. Attach sloping-top units to metal lockers, with closures at exposed ends.
5. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
6. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single roller.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations. Show mounting details for shades, attachments to other Work, operational clearances, and relationship to adjoining work.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Roller-Shade Schedule: Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Warranty sample.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roller shades to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Source Limitations: Obtain roller shades from single source from single manufacturer.

C. Fire-Test-Response Characteristics: Provide products passing flame-resistance testing according to NFPA 701 by a testing agency acceptable to authorities having jurisdiction.

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.9 WARRANTY

A. Manufacturer’s Hardware and Shade Fabric Warranty: Manufacturer agrees to repair or replace roller window shades that fail in materials or workmanship within specified warranty period.

1. Failures include but are not limited to mounting hardware, headbox, clutch, fascia and shade fabric.
2. Warranty Period: 25 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Draper, Inc.
2. Hunter Douglas, Inc.
3. Lutron Shading Solutions
4. MechoShade Systems, Inc.
5. Springs Window Fashions Division, Inc.; Bali.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Nickel-plated metal.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: As standard with manufacturer to suit installation.
2. Direction of Shadeband Roll: Regular, from back of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.

E. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum, enclosed in sealed pocket of shadeband material.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
   a. Shape: L-shaped.
   b. Height: Manufacturer's standard height required to conceal roller and shadeband when shade is fully open, but not less than 3 inches.
2. Endcap Covers: To cover exposed endcaps.
3. Installation Accessories Color: As selected by Architect from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: PVC-coated fiberglass.
3. Orientation on Shadeband: Railroaded.
4. Openness Factor: 3 to 5 percent, as selected by Architect.
5. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER-SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
2. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123661 - QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Quartz agglomerate countertops, backsplashes, and end splashes.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge profiles, and methods of joining.

C. Samples: For each type of material exposed to view.

D. Workmanship Samples:

1. Provide a workmanship sample for the following:

a. Joint for applied edge detail,
b. All edge profiles,
c. Design details.

2. Obtain Architect's approval of samples prior to fabrication of quartz countertops.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate simulated stone countertops similar to that indicated for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate **(SS-1, AA-SS-1, UA-SS-1, UA-SS-2,** and **DL-SS-1)**: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.

1. Colors and Patterns: As indicated on Finish Legend.
2. Thickness: As indicated on Finish Legend.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration: Provide countertops with the following front and backsplash style:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. Endsplash: Matching backsplash.

C. Countertops and Backsplashes: 3/4-inch- thick, quartz agglomerate.

D. Joints: Fabricate countertops in sections for joining in field, with joints at locations as approved by Architect.

2.3 ACCESSORIES

A. Grommets for Cable Passage through Countertops: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage; color as selected from manufacturer’s full range.

B. Metal Edge: Stainless steel, ASTM A 240 or ASTM A 666, Type 304, No. 4 finish.

2.4 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.

B. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661

ILM TERMINAL IMPROVEMENTS
CONTRACT 2

WILMINGTON INTERNATIONAL AIRPORT
1740 AIRPORT BOULEVARD, SUITE 12
WILMINGTON, NC 28405

PROJECT MANUAL

NOVEMBER 30, 2018



Architect: The Wilson Group
Project Manager & Civil Engineer: Talbert & Bright
Consulting Architect: LS3P
Structural Engineer: Stewart
P, M, & E Engineer: Cheatham & Associates, P.A.
Baggage Handling Consultants: BNP
Specialty Lighting Consultant: Hartranft
Signage & Wayfinding: Takeform

Volume 2 of 2

DOCUMENT 000107 - SEALS PAGE

1.1 DESIGN PROFESSIONALS OF RECORD

A. Architect:

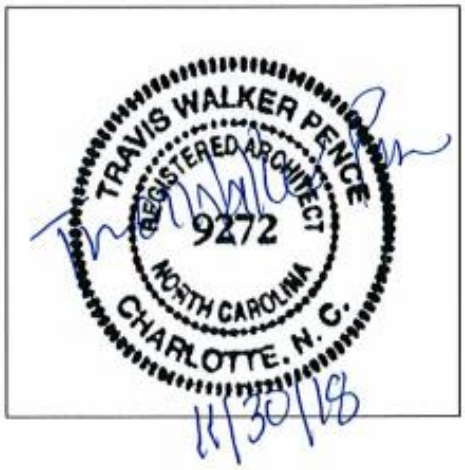
The Wilson Group Architects
2113 Commonwealth Avenue
Charlotte, NC 28205
Phone: 704.331.9747
NC Certificate No. 51140

Responsible for Specifications Sections accompanied by "The Wilson Group" in the header area of the document and not otherwise prepared by other design professionals of record.



Travis Walker Pence, AIA
NC License 9272

Responsible for Specifications Sections accompanied by "The Wilson Group" in the header area of the document and not otherwise prepared by other design professionals of record.



B. Consulting Architect:

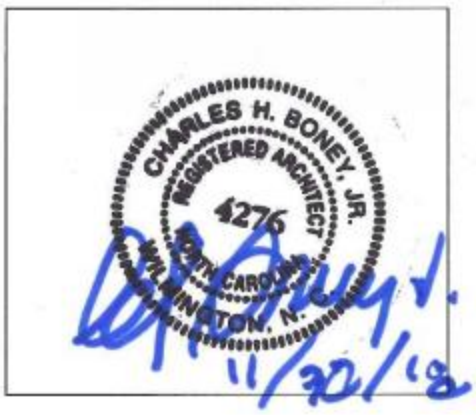
LS3P Associates Ltd.
101 N. Third Street, Suite 500
Wilmington, NC 28401
Phone: 910.790.9901
NC Certificate No. 50417

Responsible for Specifications Sections accompanied by "LS3P" in the header area of the document and not otherwise prepared by other design professionals of record.



Charles H. Boney, Jr., FAIA
NC License 4276

Responsible for Specifications Sections accompanied by "LS3P" in the header area of the document and not otherwise prepared by other design professionals of record.



C. Civil Engineer:

Talbert & Bright
4810 Shelley Drive
Wilmington, NC 28405
Phone: 910.763.5350
Firm No. NC C-0713

Eric Stumph, PE
NC License 024169

Responsible for Specifications Sections accompanied by "Talbert & Bright" in the header area of the document and not otherwise prepared by other design professionals of record.

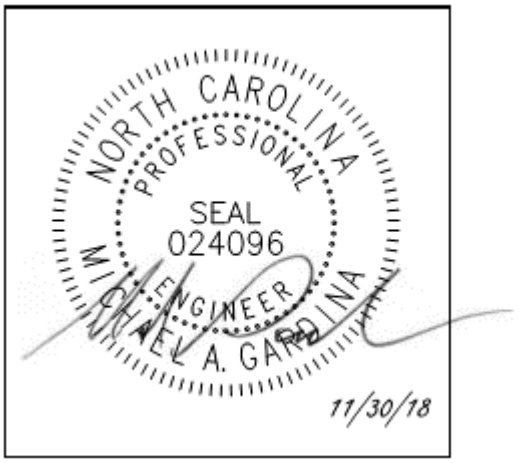


D. Structural Engineer:

Stewart
101 N. Tryon Street, Suite 1400
Charlotte, NC 28202
Phone: 704.373.1907
Firm No. NC C-1051

Michael A. Gardina, PE
NC License 24096

Responsible for Specifications Sections accompanied by "Stewart" in the header area of the document and not otherwise prepared by other design professionals of record.



E. Fire-Protection/Plumbing Engineer:

Cheatham & Associates, PA
3412 Enterprise Drive
Wilmington, North Carolina 28405
Phone: 910.452.4210
Firm No. NC C-1073

Casey D. Gilman, PE
NC License 043164

Responsible for Specifications Sections accompanied by "Cheatham & Associates" in the header area of the document and not otherwise prepared by other design professionals of record.

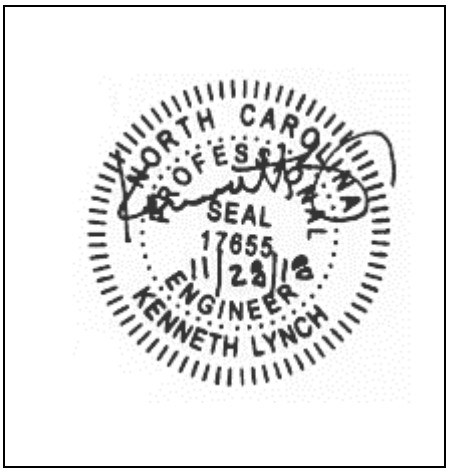


F. HVAC Engineer:

Cheatham & Associates, PA
3412 Enterprise Drive
Wilmington, North Carolina 28405
Phone: 910.452.4210
Firm No. NC C-1073

Kenneth Lynch, PE
NC License 17655

Responsible for Specifications Sections accompanied by "Cheatham & Associates" in the header area of the document and not otherwise prepared by other design professionals of record.



G. Electrical Engineer:

Cheatham & Associates, PA
3412 Enterprise Drive
Wilmington, North Carolina 28405
Phone: 910.452.4210
Firm No. NC C-1073

Mark A. Ciarrocca, PE
NC License 17593

Responsible for Specifications Sections accompanied by "Cheatham & Associates" in the header area of the document and not otherwise prepared by other design professionals of record.



END OF DOCUMENT 000107

SECTION 000110 - TABLE OF CONTENTS

VOLUME ONE

BIDDING INFORMATION

Advertisement for Bids (Previously Published)
Invitation to Bid
Instructions to Bidders - AIA Document A701- 1997
Supplementary Instructions to Bidders
Baggage Handling System (BHS) Price Schedule
Baggage Handling System (BHS) Unit Pricing
Bidder's Request for Information Form
Bidder's Request for Substitution Form
Bid Form

MBE GUIDELINES AND FORMS

Important Notice to Bidders
Bid Conditions
Report of Participating Subcontractors and Suppliers
Certification of Competitive Bids
NHC MBE Subcontractor Contact Schedule
Good Faith Effort Affidavit

PROJECT INFORMATION

003132 Project Information
Geotechnical Engineering Report
Report of Pavement and Subsurface Investigation
Report of Subsurface Investigation Duct Bank Near Outbound Baggage
Report of SUE Results
July 2018 Airline Schedule

CONTRACT DOCUMENTS

New Hanover County Airport Authority Contract

DIVISION 1 - GENERAL REQUIREMENTS

011000 Summary
E-Verify Affidavit
Federal Contract Provisions
Section 10 - General Conditions - Definition of Terms
Section 20 - General Conditions - Proposal Requirements and Conditions
Section 30 - General Conditions - Award and Execution of Contract
Section 40 - General Conditions - Scope of Work
Section 50 - General Conditions - Control of Work
Section 60 - General Conditions - Control of Materials
Section 70 - General Conditions - Legal Regulations and Responsibility to Public
Section 80 - General Conditions - Execution and Progress
Section 90 - General Conditions - Measurement and Payment
012100 Allowances
012200 Unit Prices
012300 Alternates
012500 Substitution Procedures

Contractor's Request for Substitution Form
012600 Contract Modification Procedures
Change Proposal Worksheet Summary
012900 Payment Procedures
013100 Project Management and Coordination
013200 Construction Progress Documentation
013233 Photographic Documentation
013300 Submittal Procedures
Digital Data Letter of Agreement
013516 Alteration Project Procedures
014000 Quality Requirements
014100 Special Inspections
014200 References
015000 Temporary Facilities and Controls
016000 Product Requirements
017300 Execution
017419 Construction Waste Management and Disposal
017700 Closeout Procedures
017823 Operation and Maintenance Data
017836 Warranties
017839 Project Record Documents
017900 Demonstration and Training

DIVISION 02 - EXISTING CONDITIONS AND SITEWORK

020050 Civil Project Special Provisions
020100 Civil Construction
020152 Earthwork
020162 Chain-Link Fence
020501 Portland Cement Concrete (PCC) Pavement
020605 Joint Sealants for Concrete Pavements
020620 Taxilane and Apron Marking
020660 Water Distribution
020701 Pipe for Storm Drains
020751 Manholes, Catch Basins and Inlets
024119 Selective Demolition

DIVISION 03 - CONCRETE

033000 Cast-In-Place Concrete

DIVISION 04 - MASONRY

042000 Unit Masonry

DIVISION 05 - METALS

051200 Structural Steel Framing
053100 Steel Decking
054000 Cold-Formed Metal Framing
055000 Metal Fabrications
055213 Pipe and Tube Railings

DIVISION 06 - WOOD, PLASTICS AND COMPOSITES

061053 Miscellaneous Rough Carpentry
061600 Sheathing

062023 Interior Finish Carpentry
064116 Plastic-Laminate-Faced Architectural Cabinets
064600 Wood Trim

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

072100 Thermal Insulation
072119 Foamed-In-Place Insulation
074213.13 Formed Metal Wall Panels
074213.19 Insulated Metal Wall Panels
075419 Polyvinyl-Chloride (PVC) Roofing
076200 Sheet Metal Flashing and Trim
077100 Roof Specialties
078100 Applied Fireproofing
078200 Board Fireproofing
078413 Penetration Firestopping
078446 Fire-Resistive Joint Systems
079200 Joint Sealants

DIVISION 08 - OPENINGS

081113 Hollow Metal Doors and Frames
081416 Flush Wood Doors
083113 Access Doors and Frames
083323 Overhead Coiling Doors
084113 Aluminum-Framed Entrances and Storefronts
087100 Door Hardware
088000 Glazing
089119 Fixed Louvers

DIVISION 09 - FINISHES

092216 Non-Structural Metal Framing
092900 Gypsum Board
093013 Ceramic Tiling
095113 Acoustical Panel Ceilings
096513 Resilient Base and Accessories
096520 Resilient Plank Flooring
096536 Static-Control Resilient Flooring
096623 Resinous Matrix Terrazzo Flooring
096813 Tile Carpeting
097000 Wall Finishes
099113 Exterior Painting
099123 Interior Painting

DIVISION 10 - SPECIALTIES

101423 Room-Identification Signage
102600 Wall Protection
104400 Fire Protection Specialties
105113 Metal Lockers

DIVISION 12 - FURNISHINGS

122413 Roller Window Shades
123661 Quartz Agglomerate Countertops

VOLUME TWO

DIVISION 21 - FIRE SUPPRESSION

210000 Fire Protection

DIVISION 22 - PLUMBING

220000 Plumbing

DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING

230500 Heating and Air Conditioning
230900 Instrumentation and Control for HVAC

DIVISION 26 - ELECTRICAL

260000 Electrical, Basics
260500 Basic Electrical Materials and Methods
260519 Conductors and Cables
260526 Grounding and Bonding
260533 Raceways and Boxes
260538 Wire Mesh Cable Trays
260548 Seismic Controls for Electrical Systems
260553 Electrical Identification
260923 Lighting Control Devices
260943 Network Lighting Controls
262200 Dry-Type Transformers (600 V and Less)
262416 Panelboards
262726 Wiring Devices
262816 Enclosed Switches and Circuit Breakers
264113 Lightning Protection for Structures
264313 Surge Protective Devices
265119 LED Interior Lighting

DIVISION 27 - COMMUNICATIONS

271100 Communications Equipment Room Fittings
271300 Communications Backbone Cabling
271500 Communications Horizontal Cabling
275116 Public Address System

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

281500 Access Control System and Security Monitoring
282300 Video Surveillance System
283111 Digital, Addressable Fire-Alarm System

DIVISION 31 - EARTHWORK

313116 Termite Control

DIVISION 34 - TRANSPORTATION

347739 Baggage Conveying Equipment

END OF TABLE OF CONTENTS

SECTION 210000 - FIRE PROTECTION

210001 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Contractor shall provide coordination drawings per Division 1.

C. Fire Protection work shall be performed as outlined in "Information for Bidders".

D. These specifications and the accompanying fire protection drawings are intended to provide for all labor, materials and equipment necessary for the installation of a complete

1. Wet-pipe sprinkler system

and accessories including necessary apparatus, valves and fittings hereinafter described or called for on the fire protection drawings accompanying these specifications.

E. All fire protection work shall be installed in accordance with the following Codes and all Local Ordinances. Codes shall be latest editions approved by the NC Building Code Council with North Carolina amendments. Materials, equipment and workmanship shall be as hereinafter specified.

1. North Carolina State Building Code
2. North Carolina State Fire Prevention Code
3. NFPA 70
4. NFPA 13

F. All products used as part of the installation of the fire sprinkler system shall be Underwriter's Laboratories (UL) or Factory Mutual (F.M.) approved as required by NFPA 13.

G. This contractor shall secure all required permits and inspection fees necessary for this work. Permits may be secured from the Building Inspections Department.

H. The accompanying drawings are schematic only and are not intended to show all fittings, couplings, hangers, offsets, etc., unless specifically dimensioned. The layout shown on the drawings is a conceptual layout only. This contractor shall provide complete installation drawings for the sprinkler systems defined herein, per the Contract Drawings and these specifications. Provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Fire protection consultant drawings should not be scaled. Secure dimensions from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All equipment shall be installed in accordance with the manufacturer's published installation instructions and diagrams.

210002 SCOPE OF WORK

A. The Contractor shall be required to perform all the following work, in general and provide a complete fire sprinkler system(s) as shown on the plans. This Contractor's scope of work begins at locations indicated on the Contract Drawings. The items in general are to be as follows:

1. Furnish and install complete wet-pipe sprinkler system as shown on the fire protection drawings and here-in specified.
2. Sprinkler Contractor is responsible for acquiring flow test data, less than one year old, from the local Fire Department, local Water Department, or by performing a flow test. Contractor shall coordinate with and get approval of date, time, and location of flow test from the local Fire Department.

210003 LIST OF MATERIALS, FIXTURES AND EQUIPMENT

A. Sprinkler system design submittal, including shop drawings, hydraulic calculations, and materials, shall be performed by a Professional Engineer registered in the State of North Carolina, or an individual who has Level III or IV certification from the National Institute for Certification in Engineering Technologies (NICET) in Fire Protection Engineering Technology: Water-Based Systems Layout in accordance with NICET 1014.

B. The Sprinkler Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials claimed as equal to those specified. Such approvals must be obtained as soon after contract awards as possible and before any materials are ordered. Applications for approvals shall be made by the Sprinkler Contractor and not by subcontractors or manufacturer's representative. The Sprinkler Contractor shall submit within ten days following award of contract and written notice to begin the work a complete list of materials proposed for the job. All like items shall be by the same manufacturer. When this list is approved, no further substitutions will be permitted except in unusual or extenuating circumstances. If no list is submitted, the Sprinkler Contractor shall supply materials specified. The Sprinkler Contractor shall review and stamp the submittals as being in accordance with his or her bid and these specifications.

C. The Sprinkler Contractor shall submit a set of installation plan drawings to the Architect before any materials, and equipment to be incorporated in the work has been ordered. **FAXED COPIES WILL NOT BE ACCEPTABLE**. Installation plan drawings shall include:

1. Hydraulic design data, including remote area designation(s), and locations of nodes.
2. Flow test data.
3. All piping, included mains, cross mains, branches, and armovers with sizes indicated.
4. Locations of couplings on grooved piping.
5. Location of Riser(s).
6. Riser Details.
7. Hanger Details.
8. Locations of sprinkler heads.
9. Sprinkler head legend, indicating the manufacturer and model number of each type of sprinkler head.
10. Location of backflow preventer.
11. Location of fire department connection and associated check valve.
12. Location of backflow preventer test header.
13. Location of inspector's test connection(s).
14. Location of auxiliary drains.
15. Location of seismic bracing.
16. Site diagram indicating water supply piping location, sizes, and hydraulic calculation nodes.
17. Preparer's NICET Certification ID or Professional Engineer Seal.
18. Coordination Drawings per Division 1.

D. The Sprinkler Contractor shall submit a set of hydraulic calculations to the Architect before any materials, and equipment to be incorporated in the work has been ordered. Hydraulic Calculations shall be performed using computer-based software, such as HydraCALC or HASS. **FAXED COPIES WILL NOT BE ACCEPTABLE**. Hydraulic Calculations shall include:

1. Required water density and size of remote area(s), in accordance with NFPA and the Authority Having Jurisdiction.
2. Pressure and flow required for the system(s) to operate properly (after hose allowance has been added).
3. Flow test data. Sprinkler Contractor shall reduce the static pressure, residual pressure, and flow by 10% when performing hydraulic calculations, per the AHJ.
4. Node by node analysis of required pressure, required flow, friction losses, and elevation.
5. Flow vs. pressure curves, indicating that sprinkler system curve(s) are sufficiently below flow test curve.

E. The Sprinkler Contractor shall submit a set of manufacturer's submittal data to the Architect before any materials, and equipment to be incorporated in the work has been ordered. **All sprinkler system components shall be UL listed and/or FM approved as required by NFPA 13.** Shop drawings shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked. All items shall be referenced to the specifications by **specification paragraph number on an index tab**. One complete set of submittal data shall be manufacturer's original published material. **FAXED COPIES WILL NOT BE ACCEPTABLE**. Approval of materials will be based upon the manufacturer's published ratings. Submit shop drawings and/or catalog data for the following material and equipment:

1. Sprinkler Heads
2. Piping, Fittings, and Couplings
3. Valves
4. Gauges
5. Hangers
6. Seismic Bracing
7. Riser Check Valve
8. Flow Switch
9. U.L. Details for penetrations in rated walls.

F. Approval of shop drawings and/or submittal data shall not relieve the Sprinkler Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc. If data submitted deviates from the contract documents, the Sprinkler Contractor shall point out such deviations in writing and also state reasons for same. All similar items shall insofar as possible be one make and manufacturer. **MANUFACTURER'S MODEL NUMBERS LISTED WITHIN DIVISION 21 SPECIFICATIONS ARE PROVIDED FOR GENERAL INFORMATION ONLY**. Description of product shall take precedence over model numbers.

G. Prior to submitting equipment information, the Contractor shall field verify all necessary dimensions to ensure that all equipment will fit within designated rooms and/or spaces with proper clearances.

H. Failure to submit materials, equipment, etc., the Architect shall assume that all items shall be installed as specified.

210004 DEMOLITION

A. General Requirements: The work includes the demolition or removal of all construction indicated, specified or necessary to accomplish the work under this contract. The drawings define the scope of work but it is not intended that all items of demolition work be specifically indicated. After carefully reviewing the drawings and specifications to determine intent, the Contractor shall visit the site and determine the extent of demolition work required to properly complete the work under his or her contract.

B. Protection of Materials and Work: Before beginning any cutting or demolition work, the Contractor shall carefully survey the existing work and examine the drawings and specifications to determine the extent of work required. The Contractor shall take all necessary precautions to insure against damage to existing work to remain in place, to be reused, or to remain the property of the Owner and any damage to such work shall be repaired or replaced at no additional cost to the Owner.

C. In the event that demolition of existing sprinkler system(s) will require the existing sprinkler system(s) to be rendered temporarily non-operational, Sprinkler Contractor shall notify the local Fire Department at least five days prior to rendering existing sprinkler system(s) non-operational. All shutdowns of existing sprinkler systems shall be scheduled in accordance with, and approved by, the local Fire Department.

210005 WORKMANSHIP

A. Layout:

1. Furnish and install all necessary sleeves, inserts, etc., for walls and partitions. Failure to install such items in time to avoid delaying the general contractor shall result in the Contractor doing all cutting and repairing at his or her own expense.
2. All equipment shall be installed in accordance with manufacturer's installation written instructions.
3. All equipment shall be installed such that components do not provide a safety hazard to occupants who come within a close proximity.

B. All equipment and components located on site shall be protected from the weather and damage from construction equipment.

C. Wet-pipe sprinkler system piping:

1. Piping shall be installed level, without slope, unless otherwise indicated on Contract Drawings.
    a. If sloped piping causes water to be trapped from draining in quantities exceeding 5 gallons, an auxiliary drain shall be provided in an accessible location.
2. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
3. All piping shall be routed with a minimum clearance of ten (10) feet from any electrical switchboards, panel boards or telephone backboards.
4. Piping shall be concealed in walls, or above ceilings, unless otherwise indicated on Contract Drawings.
    a. No sprinkler piping shall be covered or concealed until inspected by the Authority Having Jurisdiction, and tested and approved by the Architect.
5. Piping shall not be installed underground.
6. Sprinkler heads shall be installed in the center of ceiling tiles.
7. Sprinkler heads shall be installed on armovers to allow their locations to be adjusted to the center of ceiling tiles.
8. Sprinkler piping shall be at least 1" in diameter.
9. Support horizontal black steel pipe with hangers located every 12 feet for piping 1-1/4" or smaller and every 15 feet for all piping 1-1/2" or larger.
10. Armovers longer than 24" shall be supported by hangers per NFPA 13.

210006 CUTTING, PATCHING AND CHASING

A. All cutting and patching shall be in accordance with the "General Conditions" of these specifications.

210007 SEISMIC RESTRAINTS

A. The Contractor shall be responsible for providing restraints to resist the earthquake effects on the sprinkler system(s), per NFPA, local codes, and the Authority Having Jurisdiction. Restraints shall be per Seismic Design Category C.

B. The Contractor shall retain the services of a Professional Engineer registered in the State of North Carolina, or an individual who has Level III or IV certification from the National Institute for Certification in Engineering Technologies (NICET), to design seismic restraint elements required for this project. The engineer's (or NICET-certified individual's) computations, bearing his or her professional seal or NICET Certification Number, shall accompany shop drawings that show Code compliance. Computations and shop drawings shall be submitted for review prior to the purchasing of materials, equipment, systems and assemblies.

C. The Professional Engineer (or NICET-certified individual) retained by the Contractor for seismic restraint calculations, shall visit the job site upon completion of the seismic restraint installation. This engineer (or NICET-certified individual) shall provide in writing verification of compliance with the approved seismic submittal. This verification shall bear the Engineer's (or NICET-certified individual's) professional seal or NICET Certification Number. Job site inspections by other than this engineer (or NICET-certified individual) is not acceptable.

D. Review of the seismic design and shop drawings by the Engineer/Architect or their agent shall not relieve the Contractor of his or her responsibility to comply with the seismic or any other requirements of the North Carolina State Building Code.

210008 WET-PIPE SPRINKLER SYSTEMS

A. Piping:

1. Sprinkler piping 2" and smaller (minimum 1") shall be Schedule 40 threaded black steel, conforming to ASTM A 795 and ANSI/ASTM A 53.
2. Sprinkler piping 2-1/2" and larger shall be Schedule 10 roll grooved black steel, conforming to ASTM A 795 and ANSI/ASTM A 53, joined with Victaulic "Firelock" couplings or approved equal by Grinnell.

B. Fittings:

1. Fittings for threaded black steel piping shall be cast iron threaded fittings.
2. Fittings for grooved black steel piping shall be ductile iron grooved fittings conforming to ASTM A 536. Fittings shall be Victaulic "Firelock" joined with Victaulic "Firelock" rigid ductile iron couplings or approved equal by Grinnell.

C. Riser:

1. Riser check valve shall have grooved connections and be rated for 250 psi, with upstream and downstream pressure gauges, and main drain valve piped to exterior of the building. Provide Reliable Model G, or approved equal by Tyco or Victaulic.
2. Electric vane-type water flow alarm switch shall consist of a U bolt and saddle with non-corrosive insert for mounting to the pipe, a non-corrosive vane and trip stem assembly for detecting waterflow and a retard time delayed switch to prevent false alarms from water surges. Waterflow switch enclosures shall be NEMA 4 rated and shall be held captive by tamper resistant screws. It shall be possible to install an optional cover tamper switch to detect removal of the enclosure. The device shall be listed for pressures up to 450 psi, maximum water surges of 18 fps and alarm activation by 10gpm. Activation shall be accomplished by the continuous flow of water against a non-corrosive paddle attached to a non-corrosive stem operating a field replaceable instantly recycling adjustable retard with a 0-90 second range and visual indication of activation. Expiration of the retard time shall result in the simultaneous operation of two sets of single pole double throw (SPDT) switch contacts rated at 10A, 125VAC and 2A, 30VDC. Each switch contact shall have a separate wiring chamber and separate conduit entrance to comply with the separation of power limited and non-power limited conductors without the need for special wire or wire methods. Provide Potter (Viking) VSR or approved equal.
3. Control Valves shall be ductile iron butterfly valves with grooved ends.
4. Connect to existing alarm bell.

210009 HANGERS

A. Hangers for vertical piping shall be the Riser Clamp design.

B. Hangers for horizontal piping shall be hanger rings attached to top beam clamps using 3/8" threaded rod. Top beam clamps shall only be attached to the top portion of structural members. All hangers shall permit adequate adjustment after erection while still supporting the load.

C. Trapeze hangers are allowed only where it is necessary due to the required piping layout and structure.

D. Trapeze hangers shall attach to the structure using top beam clamps located on both sides of trapeze hanger. Top beam clamps shall only be attached to the top portion of structural members.

E. Hangers **SHALL NOT** be fastened to joist bridging or roof deck.

210010 VALVES

A. Valves not specified elsewhere in Division 21 shall be UL listed and/or FM approved as required by NFPA 13, and shall be listed specifically for fire protection service.

210011 PIPE SLEEVES, PLATES, ESCUTCHEONS, ETC.

A. Pipe sleeves shall be standard weight schedule 40 black steel. All sleeves shall be equal to construction thickness except that pipe sleeves passing through floors above grade, shall extend 3/4" above the finished floor. Pipe sleeve sizes shall be sized two pipe sizes larger than piping passing thru the sleeve.

B. Piping thru non-fire rated walls, floors above slab on grade or ceilings shall have sleeves installed concentric and centered on pipe. Ream all sleeves to prevent cutting of piping. The Contractor shall furnish shop drawings to the general contractor and the Architect showing location, dimensions, and sizes of holes required.

C. Install escutcheons snug against room finish on all exposed pipe passing through walls, floors above slab on grade or ceilings. Use cup type escutcheons at floors where sleeves extend above finished floors. Escutcheons shall be chrome plated steel with spring clip as by Keeny, Connecticut Stamping and Bending Company of Dearborne.

D. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.

E. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through–penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479 with a minimum positive pressure differential 0.01 inch w.g. All openings through horizontal fire separations shall be protected by Metacaulk U.L. Systems or approved U.L. listed system by other manufacturers.

F. All openings through floors and vertical fire separations shall be protected by combination water seal and fire stops as manufactured by Presealed Systems or approved equal by Proset, or approved equal by Metacaulk or 3M.

210012 SPRINKLER SYSTEM IDENTIFICATION

A. Each individual riser shall be marked with a metal hydraulic placard containing the following data:

1. Location of area protected by riser.

2. Total number of sprinkler heads connected to riser.
3. Design density and design area, as approved.
4. Required flow rate and pressure at the base of the riser, as approved.

210013 SPRINKLER HEADS

A. Sprinkler head types shall be as indicated on the Contract Drawings, and shall be listed for the proposed application.

B. All sprinkler heads shall be quick response type, unless otherwise indicated on the Contract Drawings.

C. All sprinkler heads shall be glass bulb type.

D. Sprinkler heads shall have ordinary temperature classification, unless otherwise indicated on the Contract Drawings, or required by NFPA 13.

E. K-Factor of sprinkler heads shall be 5.6 or 8.0.

F. Add spare heads of each type installed within the building to existing spare sprinkler head cabinet, as required by NFPA 13. Provide additional spare sprinkler head cabinet(s) as needed. Provide at least one wrench of each type required.

210014 PROTECTION OF WORK AND EQUIPMENT

A. The Contractor shall be responsible for all work damaged by him or her. Any fire sprinkler system work damaged by any other contractor shall be replaced by the Contractor and placed in perfect working condition without extra cost to the Owner. All sprinkler heads, valves, pipe, fittings, and equipment shall be adequately protected before, during and after installation.

B. The Contractor shall be responsible for all sprinkler heads, valves, pipe, fittings, and equipment at time of final inspection. Any broken items will be replaced by the Contractor at no cost to the owner regardless of by whom the item was broken.

210015 TESTING

A. The Contractor shall notify the Engineer forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to ensure a functional system, which shall include flushing, testing, and inspection of sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.

B. All tests shall be applied before any work is concealed or covered in any manner.

C. All tests shall be conducted with regard to safety of all personnel on site.

D. The Authority Having Jurisdiction shall be alerted to and invited to witness all Division 21 tests.

E. Preliminary Tests:

1. All sprinkler piping, shall be made tight under a hydrostatic test pressure of 50 psi greater than the required design pressure, or 200 psi, whichever is greater. Hydrostatic test pressure shall be maintained without pressure loss for a minimum of two (2) hours. No caulking of joints will be permitted. Test pressure shall be read from a gauge located at the low elevation point of the system that is under test pressure. Any joint found to leak under this test shall be broken, remade and a new test applied.

2. Waterflow detecting devices, including associated alarm circuits, shall be flow tested using the inspector's test connection. Alarm bell must be audible on premises within five (5) minutes of fully opening inspector's test connection. Each water-operated alarm device shall be tested to verify proper operation.
3. Each tamper switch shall be tested by operating the associated valve.
4. Following flushing of the underground piping, a main drain test shall be made to verify the adequacy of the water supply. Static and residual pressures shall be recorded and submitted. In addition, a main drain test shall be conducted each time after a main control valve is shut and opened.
5. Energize circuits to electrical equipment and devices.
6. Verify that equipment hose threads are same as local fire department equipment.
7. Main drain valves shall be opened until the system pressure stabilizes.
8. All control valves shall be fully opened and closed under system water pressure to ensure proper operation.
9. All backflow preventers shall be tested and certified by an approved and licensed backflow prevention company.
10. All alarms, supervisory signals, and trouble signals that are related to the sprinkler system shall be activated and verified.

F. A final acceptance test shall be conducted, only after all above tests have been successfully conducted and reports have been submitted and approved, in which a technician employed by the installing Sprinkler Contractor shall provide a complete demonstration of the operation of the system. This demonstration shall include operation of control valves and flowing of inspector's test connections to verify operation of associated waterflow alarm switches, as well as a subsequent main drain test to verify that the control valves are in the open position. The technician shall have a copy of all "as-built" drawings, as well as certificates of previously conducted tests listed above. The sprinkler system installation shall not be considered accepted until as identified problems have been corrected, and the system is successfully retested. It is also required that the test documentation is properly completed and received prior to system acceptance.

G. Prior to making a request of Beneficial Occupancy the Sprinkler Contractor shall submit written test reports and certificates as required by NFPA 13 and 24. Submittals shall include system acceptance forms copyrighted by NFPA which shall bear the NFPA copyright symbol. No other forms shall be considered.

H. Sprinkler piping system will be considered defective if it does not pass tests and inspections. Replace damaged and malfunctioning controls and equipment, and retest as necessary.

I. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests. All equipment and materials shall be in excellent condition.

210016 PLACING IN SERVICE

A. The Contractor shall furnish Owner's representative with Contractor's Material and Test Certificate, per NFPA.

B. The Contractor shall instruct and train the Owner's staff regarding sprinkler system operation and function.

C. The Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period.

210017 ELECTRICAL WIRING

A. Equipment and tamper switch connections to alarm and supervisory systems shall be provided by Fire Alarm Contractor.

210018 OPERATING AND MAINTENANCE MANUAL

A. Four (4) complete sets of all operation and maintenance manuals **shall** be delivered by the Contractor to the Owner thru the Architect. The manuals **shall** be installed in 3-ring hard cover heavy duty notebooks with the name of the project and the words "**Operation and Maintenance Manual**" permanently affixed to the **cover** and **spine**. All items for the project shall be separated by identification tabs correlated to the index. The manuals **shall** contain the following items as a minimum:

1. Index and page number.
2. Certificate of substantial completion.
3. A summary sheet of warranties with dates noted and a copy of all warranties.
4. List of subcontractors and suppliers with names, addresses, and phone numbers.
5. Backflow preventer certificate of operation.
6. All documented results of preliminary and system acceptance testing.
7. Complete start-up, operation, and shutdown procedures for each system including sequence of events, locations of switches, emergency procedures, and any other critical items
8. Lubrication schedules and types of lubricants.
9. Complete set of Sprinkler Contractor's record drawings and hydraulic calculations.
10. Equipment summary showing all capacities and ratings (HP, KW, etc.).
11. Operation manuals, installation manuals, and parts list for all installed equipment.
12. All submittal data indexed with tabs.
13. Copy of NFPA 25, edition to match that which is currently enforced by the Authority Having Jurisdiction.

B. One copy shall be manufacturers original published literature with manufacturers name on all items. **FAXED COPIES WILL NOT BE ACCEPTABLE**.

210019 AS BUILT DRAWINGS

A. The General Contractor and Sprinkler Contractor, shall maintain "during the course of the work" a set of drawings marked up to show the work as installed. Both Contractors shall initial and date all changes to the contract drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, Sprinkler Contractor shall use these as-built drawings to create a set of record drawings which shall be delivered to the Architect.

210020 GUARANTEE

A. Guarantee: The Contractor shall guarantee the entire fire sprinkler system subject to the General Conditions of these specifications.

210021 BIDDING PROCEDURE

A. The Contractor shall provide bidding for Alternate Bids in accordance with Division 1 of these specifications. Contractor shall refer to Division 1 for any required unit prices and allowances.

END OF SECTION 210000

SECTION 220000 - PLUMBING

220001 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this section.

B. Contractor shall provide coordination drawings per Division 1.

C. Plumbing work shall be performed as outlined in "Information for Bidders".

D. These specifications and the accompanying plumbing drawings are intended to provide for all labor, materials and equipment necessary for the installation complete of all

1. Plumbing Fixtures
2. Equipment
3. Rough-Ins
4. Waste And Vent System
5. Condensate Drainage System
6. Cold Water System
7. Hot Water System
8. Roof Drainage System

and accessories including necessary apparatus, valves and fittings hereinafter described or called for on the plumbing drawings accompanying these specifications.

E. All plumbing work shall be installed in accordance with the following Codes and all Local Ordinances. Materials, equipment and workmanship shall be as hereinafter specified.

1. North Carolina State Plumbing Code
2. North Carolina State Fire Prevention Code
3. North Carolina Electrical Code
4. North Carolina Accessibility Code
5. NSF Standard # 61

F. This contractor shall secure all required permits and inspection fees necessary for this work. Permits may be secured from the Building Inspections Department.

G. The accompanying drawings are schematic only and are not intended to show all fittings, bolts, connections, offsets, etc., unless specifically dimensioned. Follow drawings as closely as possible, provide all adjustments as necessary to conform to the structural conditions, machinery, equipment, work of other contractors and the intent of the drawings, without additional cost to the Owner. Plumbing drawings should not be scaled. Secure dimensions from Architectural drawings. Refer to drawings of other trades and coordinate with other contractors. All items of equipment shall be installed in accordance with the manufacture published installation instructions and diagrams.

H. The Contractor shall coordinate water and sewer taps and pay all fees in conjunction to provide services as required, for this project.

220002 SCOPE OF WORK

A. The Contractor shall be required to perform all the following work, in general and provide a complete plumbing system as shown on the plans. The items in general are to be as follows:

1. Furnish and install complete waste and vent system with connections to services as shown on the plumbing drawings and here-in specified.

2. Furnish and install cold water system complete with connections to point as shown on the plumbing drawings and here-in specified.
3. Furnish and install hot water system complete with connections to equipment as shown on the plumbing drawings and here-in specified.
4. Furnish and install roof drainage leader system as shown on the plumbing drawings and here-in specified.
5. Furnish and install condensate drainage system as shown on the plumbing drawings and here-in specified.
6. Provide connections to equipment furnished and installed by General Contractor or Owner as shown on the plumbing drawings and here-in specified.

220003 LIST OF MATERIALS, FIXTURES AND EQUIPMENT

A. The Plumbing Contractor shall obtain written approval from the Engineer/Architect for the use of substitute materials claimed as equal to those specified. Such approvals must be obtained as soon after contract awards as possible and before any materials are ordered. Applications for approvals shall be made by the Plumbing Contractor and not by subcontractors or manufacturer representative. The Plumbing Contractor shall submit within ten days following award of contract and written notice to begin the work a complete list of materials proposed for the job. All like items shall be by the same manufacturer. When this list is approved, no further substitutions will be permitted except in unusual or extenuating circumstances. If no list is submitted, the Contractor shall supply materials specified. *Contractor should note that all items specified in section 220000 shall be submitted independently of other 220000 series sections.* The Plumbing Contractor shall review and stamp the submittals as being in accordance with his bid and these specifications. **Private labeled materials are not acceptable.**

B. The Plumbing Contractor shall submit shop drawings to the Architect within 20 days after award of the contract, and before any materials, fixtures, and equipment to be incorporated in the work has been ordered. Shop drawings shall include the name and address of the manufacturer and their catalog numbers and trade names clearly marked. All items shall be referenced to the plans and specifications by **fixture designation or specification paragraph number on an index tab**. One complete set of submittal data shall be manufacturer's original published material. **FAXED COPIES WILL NOT BE ACCEPTABLE**. Approval of materials will be based upon the manufacturer's published ratings. Submit shop drawings and/or catalog data for the following material and equipment:

1. Waste Piping, Fittings and Couplings
2. Condensate Piping, Fittings and Couplings
3. Water Piping, Fittings and Equipment
4. Roof Drainage Piping, Fittings and Couplings
5. Cleanouts and Access Doors
6. Valves
7. Insulation
8. Hangers
9. U. L. penetration system details
10. Pipe Markers
11. Fixtures
12. Coordination Drawings per Division 1.

C. Approval of shop drawings and/or submittal data shall not relieve the Plumbing Contractor of the responsibility to comply with the requirements and intent of the plans and specifications with regard to dimensions, capacities, quality, quantity, performance characteristics, etc. If data submitted deviates from the contract documents, the Plumbing Contractor shall point out such deviations in writing and also state reasons for same. All similar items shall insofar as possible be one make and manufacturer.

D. Where any special make, fixture or materials are specified by plate number, trademark or name, deliver to the building with original labels or other identification marks placed thereon by the manufacturer and

do not remove until inspected and approved by the Architect. Similar and equal materials and equipment by other manufacturers will be acceptable, subject to approval.

E. Failure to submit materials, equipment, fixtures, etc., in the time period specified above, the Architect shall assume that all items shall be installed as specified.

220004 DEMOLITION

A. General Requirements: The work includes the demolition or removal of all construction indicated, specified or necessary to accomplish the work under this contract. The drawings define the scope of work but it is not intended that all items of demolition work be specifically indicated. After carefully reviewing the drawings and specifications to determine intent, the Contractor shall visit the site and determine the extent of demolition work required to properly complete the work under his contract.

B. Protection of Materials and Work: Before beginning any cutting or demolition work, the Contractor shall carefully survey the existing work and examine the drawings and specifications to determine the extent of work required. The Contractor shall take all necessary precautions to insure against damage to existing work to remain in place, to be reused, or to remain the property of the Owner and any damage to such work shall be repaired or replaced at no additional cost to the Owner.

220005 WORKMANSHIP

A. Layout:

1. Drawings indicate general locations of fixtures. Secure exact location from Architectural plans before proceeding with work.
2. Furnish and install all necessary sleeves, inserts, bolts, etc., for concrete floor slabs, roof, walls, and partitions. Failure to install such items in time to avoid delaying the general contractor shall result in the Contractor doing all cutting and repairing at his own expense.
3. Sleeves as here-in-after specified shall be installed on all through the floor piping above slab on grade except water closet rough-ins. Water closet rough-ins shall be cast in place. Core drilling of slabs shall be sealed with approved fire retardant caulking and sealed watertight.
4. All equipment shall be installed in accordance with manufactures installation written instructions.

B. Drainage, Waste and Vent Piping:

1. Grade all sanitary waste lines 2" and smaller 1/4" per foot.
2. Grade all sanitary waste lines 3" and larger 1/4" per foot, where possible, 1/8" per foot minimum.
3. Grade all condensate drain lines 1/8" per foot.
4. All underground piping shall be graded by the use of a laser beam alignment system.
5. Run all piping as directly as possible, avoiding unnecessary bends and turns so as not to interfere with proper installation of work of other contractors.
6. Provide removable caps for cleanouts with at least six threads engaged. Provide cleanouts at foot of waste and drainage stacks, all changes in direction of horizontal lines more than 135 degrees, in straight lines at intervals not exceeding 100-feet and anywhere additionally noted on the drawings.
7. Support horizontal cast iron soil pipe with a minimum of one hanger for each pipe length. Location close to hub or no-hub connector. Support vertical pipe at each floor or at intervals not exceeding 10-feet.
8. Run all horizontal and vertical piping true and plumb to building structure and connect all piping with ‘Y’ branches and 1/8 or 1/16 bends.
9. Tapped tees and crosses will not be permitted. Tapped sanitary tees and crosses shall be used.
10. No soil, waste, or vent piping shall be covered or concealed, until tested and approved by the Architect.

11. Conceal all soil and vent piping. Vents shall be tied together as shown with minimum number of vents extending through roof. All vents extended through the roof shall be a minimum of 12" above roof level.

C. Water System:

1. Conceal water supply piping in walls, below floor or above ceiling except where exposed for connections to fixtures. Install and secure all piping as walls are built. Wedging of piping will not be permitted. All piping shall be isolated from mortar.
2. All water piping shall be routed with a minimum clearance of ten (10) feet from any electrical switchboards, panel boards or telephone backboards.
3. Arrange all pipes to freely drain through a ball valve when water is cut off. All branch valves shall be installed adjacent to the water piping main.
4. All supplies to fixtures shall have individual stop valves.
5. Provide water hammer shock arrestors as required to prevent water hammer. Arresters shall be A.S.S.E. Standards Number 1010 certified. Arresters shall be installed in accordance with manufactures published recommendations. Air chambers are not acceptable. Water hammer shock arrestors shall be as manufactured by Precision Plumbing Products, Inc. or approved equal by Zurn, Josam, J.R. Smith. 12" x 12" access door shall be provided for all shock arrestors.
6. All exposed piping to fixtures shall be chrome plated installed true and plumb.
7. Insulate all water piping inside the building as hereinafter specified.
8. All tees shall be installed such that the flow shall be straight thru the tee and/or out the side. Tees **shall not** be installed where the flow is into the side and out of both ends of the tee (bullhead tee). Bullhead tees installations are not acceptable and shall not be used.
9. Extend water lines to water mains where shown on the plans.

D. Roof Drainage Piping:

1. Roof drains shall be provided by the Plumbing Contractor and installed where shown on the architectural roof plan by the General Contractor. The Plumbing Contractor shall connect to these roof drains and install the collector and leader system as shown on the plans.
2. Grade all horizontal leaders with slopes as shown on the drawings, 1/8" per foot minimum.

E. Insulation:

1. All pipe insulation joints shall be sealed to maintain integrity of the vapor jacket and shall pass thru all sleeves unbroken except for fire stops.
2. Pipe insulation at all fire separations shall be butted tightly to the firewall or to the floor after fire stop material has been installed.

220006 CUTTING, PATCHING AND CHASING

A. All cutting and patching shall be in accordance with the "General Conditions" of these specifications.

220007 EXCAVATION, TRENCHING AND BACKFILLING

A. All excavation, trenching and backfilling shall be in accordance with Division 02.

220008 WASTE & VENT SYSTEMS

A. Piping:

1. Sanitary waste piping 2" and larger below ground shall be service weight bell and plain end cast iron conforming to ASTM A-74 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.

2. All waste and vent piping 2" and larger above grade be no-hub cast iron conforming to C.I.S.P.I. Standards 301 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.

B. Fittings:

1. Fittings for cast iron waste and vent piping shall be of the sanitary drainage pattern and conforming to piping specification and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.

C. Joints:

1. Joints for below slab on grade cast iron waste piping and vent piping shall be made up using Neoprene push joint gaskets conforming to ASTM C-564.
2. Joints for hubless cast iron piping shall be made using neoprene gasket and stainless steel clamping band conforming to C.I.S.P.I. Standards 310. Bands shall be same manufacturer as piping and shall carry the NSF Logo.
3. Flashing of plumbing vents will be provided by the General Contractor.

220009 CONDENSATE DRAINAGE

A. Piping:

1. Condensate drainage piping 2" and larger below ground shall be service weight bell and plain end cast iron conforming to ASTM A-74 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
2. Condensate drainage piping 2" and larger above grade be no-hub cast iron conforming to C.I.S.P.I. Standards 301 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.

B. Fittings:

1. Fittings for cast iron condensate drainage piping shall be of the sanitary drainage pattern and conforming to piping specification and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.

C. Joints:

1. Joints for below slab on grade cast iron condensate drainage piping shall be made up using Neoprene push joint gaskets conforming to ASTM C-564.
2. Joints for hubless cast iron piping shall be made using neoprene gasket and stainless steel clamping band conforming to C.I.S.P.I. Standards 310. Bands shall be same manufacturer as piping and shall carry the NSF Logo.

220010 HOT AND COLD WATER SYSTEMS

A. Water Piping:

1. Water piping 4" and smaller above grade inside the building shall be Type 'L' hard copper conforming to ASTM B-88.

B. Fittings:

1. Fittings for copper piping shall be wrought copper, solder joint fittings conforming to ANSI B 16.22.

C. Joints:

1. All copper piping joints, 1-1/4" and smaller shall be made using lead free solder with a minimum melting point of 410 degrees Fahrenheit.

220011 ROOF DRAINAGE SYSTEM

A. Piping:

1. Roof drain leaders above grade shall be hubless cast iron piping conforming to C.I.S.P.I. Standards 301 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.
2. Roof drain leaders below slab on grade shall be service weight bell and plain end cast iron soil pipe conforming to ASTM A-74 and shall carry country of origin, manufacturer's name or manufacturer's registered trade-mark.

B. Fittings:

1. Fittings for cast iron roof drain leaders shall be the sanitary drainage pattern cast iron conforming to ASTM A-74 and shall be marked with the Cast Iron Soil Pipe Institute symbol cast into the fitting.

C. Joints:

1. Joints for below slab on grade cast iron roof drainage piping shall be made up using Neoprene push joint gaskets conforming to ASTM C-564.
2. Joints for hubless cast iron piping shall be made using neoprene gasket and stainless steel clamping band conforming to C.I.S.P.I. Standards 310. Bands shall be same manufacturer as piping and shall carry the NSF Logo.

D. Drains:

1. Primary roof drains shall be large sump body coated cast iron drains with galvanized cast iron domes, adjustable extension, combination flashing device/gravel guard, static extension and top set deck plate. Drains shall be Zurn ZC-100-DP-E or approved equal by Josam, J. R Smith, Wade or Watts. Height of static extension shall be as shown on architectural drawings. No hub outlet shall be sized as shown on the drawings.

220012 CLEANOUTS AND ACCESS DOORS

A. Cleanouts shall be the same diameter as the pipe they are connected to. If the pipe is greater than 4" in diameter, the cleanout shall be 4".

B. Cleanouts installed in walls or pipe chases shall be installed using cast iron cleanout tee with cast bronze slotted plug, stainless steel cover with vandalproof securing screw. Cleanouts shall be Zurn ZS-1468, Josam 58600-PLG, or J. R. Smith 4472.

C. Cleanouts installed in floors and walks shall have adjustable cast iron body with cast brass plug, lead seal and round nickel bronze top with watertight gasketed cover. Cleanouts shall be Zurn ZN-1400, or approved equal by Josam or J. R. Smith.

D. Cleanouts installed in crawl space or above ceiling, where permitted by authority having jurisdiction, shall be a pipe cap installed using a no-hub band and clamp.

220013 VALVES

A. Valves shall be installed at all points noted on the plans by standard symbols or as required by best general practice for proper control and operation of the system.

B. Check valves 2 inch and smaller shall be Class 125, lead free design cast bronze body with threaded ends.

C. Domestic cold and hot water system valves 1-1/4 inch and smaller shall be lead free design cast bronze body, full ported, soldered end ball valves rated for Class 150, 200 WOG service.

220014 PIPE INSULATION

A. All plumbing pipe insulation systems shall be installed as a subcontract to the Plumbing contract. All plumbing pipe insulation systems, including jacketing, coverings, adhesives when used, shall have a flame spread rating not exceeding twenty-five (25) and a smoke development rating not exceeding fifty (50) when the insulation assembly is tested as a composite. Fibrous glass pipe insulation shall be pre-molded with a thermal conductivity of 0.24BTU/in/hr/ft^2 at 100°F.

1. Insulate all cold water piping above grade with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier jacket.
2. Insulate all hot water piping, 1-1/2" and smaller, above grade with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant jacket.
3. Insulate all hot water return piping with 1" thick fibrous pre-molded glass pipe insulation with self-sealing fire retardant jacket.
4. All drain bodies receiving rain water shall be insulated with 1" thick insulating cement insulation.
5. All roof drain leaders, horizontal and vertical, above slab on grade shall be insulated with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier jacket.
6. All condensate drainage piping, horizontal and vertical, above slab on grade serving air conditioning condensate shall be insulated with 1" thick pre-molded fibrous glass pipe insulation with self-sealing fire retardant vapor barrier. Condensate P-traps shall be insulated with 1" thick insulating cement insulation.
7. Rigid pipe insulation inserts shall be provided for all insulated piping 2" and larger.

B. Exposed pre-molded pipe insulation in finished areas and mechanical rooms shall be finished with factory jacket neatly pasted in place.

C. All pipe insulation for pipe fittings shall be pre-molded to fit fittings and shall be enclosed under pre-molded PVC fitting jacket.

220015 HANGERS

A. Hangers for vertical piping shall be the Riser Clamp design and shall be Modern Fig. 500, Grinnell/Anvil Fig. 261, or approved equal by Elite Components.

B. Hangers for horizontal piping shall be the Clevis type and shall be Modern Fig. 590, Grinnell/Anvil Fig. 260 or approved equal by Elite Components.

C. **Hangers for insulated piping shall extend around the insulation.** Provide 16 gage galvanized steel insulation protection saddles 12" long at each hanger on all insulated lines. At the contractor's option, hangers for insulated piping may be Michigan Hangers Model 4031 or 4041. Insulation Shields shall cover lower 180 degrees of pipe in the case of clevis hangers, and entire circumference of pipe in the case of trapeze hangers or clamps.

D. Hangers shall be spaced per the NC State Plumbing Code in accordance with the piping material.

E. A hanger shall be provided within one (1) foot of each bend in horizontal piping. Vertical piping shall be supported at each floor or at intervals not exceeding ten (10) feet. Support cast iron soil pipe to each joint.

F. For piping 4” in diameter and larger, rigid support sway bracing shall be provided at changes in direction greater than 45 degrees.

G. Hangers shall be installed by means of threaded rods fastened directly to building structure.

H. Hangers SHALL NOT be fastened to joist bridging or roof deck.

I. Piping supported on a trapeze hanger shall be secured to the trapeze hanger by means of a pipe clamp around the pipe insulation and insulation saddle. Bare piping shall be secured by a pipe clamp and isolated by an isolation cushion.

J. Piping supported from the floor shall be supported using a base plate securely anchored to the floor and be equipped with a pipe riser. Riser shall be a minimum size of one inch. Horizontal piping above the floor shall be anchored and rest on a manufactured saddle. Piping shall be secured to each saddle as approved by the Engineer.

220016 PIPE SLEEVES, PLATES, ESCUTCHEONS, ETC.

A. Pipe sleeves shall be standard weight schedule 40 black steel above slab on grade or cast iron below slab on grade. All sleeves shall be equal to construction thickness except that pipe sleeves passing through floors, other than slab on grade, shall extend 3/4" above the finished floor. Pipe sleeve sizes shall be sized two pipe sizes larger than piping passing thru the sleeve.

B. Piping thru non-fire rated walls, floors above slab on grade or ceilings, piping passing through foundation walls, and piping installed below structural footings shall have sleeves installed concentric and centered on pipe. Ream all sleeves to prevent cutting of piping. The Contractor shall furnish shop drawings to the general contractor and the Architect showing location, dimensions, and sizes of holes required. Sleeves on piping passing through foundation walls shall extend 6” beyond wall footing on both sides. Sleeves on piping installed below structural footings shall extend beyond footing as indicated on contract drawings.

C. Install escutcheons snug against room finish on all exposed pipe passing through walls, floors above slab on grade or ceilings. Use cup type escutcheons at floors where sleeves extend above finished floors. Escutcheons shall be chrome plated steel with spring clip as by Keeny, Connecticut Stamping and Bending Company of Dearborne.

D. Sleeves for insulated piping shall be large enough to allow the insulation to pass thru sleeve unbroken.

E. Core drill openings for all floor openings may be utilized in lieu of sleeved openings. All openings shall be sized two pipe sizes larger than pipe passing thru the opening. All cored openings shall be fireproofed as required and shall be made water tight.

F. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an “F” rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a “T” rating equivalent to the rating of the floor being penetrated. Through–penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479 with a minimum positive pressure differential 0.01 inch w.g. All openings through horizontal fire separations shall be protected by Metacaulk U.L. Systems or approved U.L. listed system by other manufacturers.

G. All openings through floors and vertical fire separations shall be protected by combination water seal and fire stops as manufactured by HoldRite, or approved equal by Proset, or approved equal by Metacaulk or 3M.

220017 PLUMBING SYSTEM IDENTIFICATION

A. All piping in the building shall be identified by snap-on pipe markers or secured with two zip ties. Markers shall have ANSI colored letters at ANSI height on ANSI colored background with flow arrows and shall be located at 10' on center along pipeline, at each tee branch and at each floor/wall penetration, both sides. A pipe marker shall be located adjacent to each valve. Pipe identification markers shall comply with ANSI A13.1 and be Custom MS-790 as manufactured by Marketing Service Incorporated or approved equal Steton, Emed or DuraLabel. Stenciling of piping and/or insulation is not acceptable. Wording on markers shall be as follows where more stringent than ANSI Standards:

1. Cold Water
2. Waste
3. Vent
4. Condensate
5. Roof drain

220018 PROTECTION OF WORK AND EQUIPMENT

A. It is imperative that waste and vent lines not be filled with concrete, concrete grindings, sand, gravel, or other foreign matter. Under no circumstances shall any line be left open while the Contractor's workers are not on the job site.

B. Plug each opening of waste and vent lines the same day it is installed with test plug securely held in place.

C. All floor drains shall be covered immediately after installation.

D. The Contractor shall be responsible for all work damaged by him/her. Any plumbing work damaged by any other contractor shall be replaced by the Contractor and placed in perfect working condition without extra cost to the Owner. All fixtures and fittings shall be adequately protected before, during and after installation.

E. The Contractor shall be responsible for all plumbing fixtures at time of final inspection. Any broken fixtures will be replaced by the Contractor at no cost to the owner regardless of by whom the fixture was broken.

220019 TESTING

A. The Contractor shall notify the Engineer forty-eight (48) hours in advance of all tests. The Contractor shall make all necessary preliminary tests to insure a tight system. Any joint found to leak under test shall be broken, cleaned and remade.

B. All tests shall be applied before any work is concealed or covered in any manner.

C. All sanitary waste and vent piping and condensate drainage piping shall be tested in the following manner: Plug all openings and fill entire waste and vent system to overflow with water and sustain a constant level for a minimum period of three (3) hours. All portions of each floor system shall be tested under a minimum of a 10-foot head including roof vent terminal.

D. All water piping, hot and cold shall be made tight under a hydrostatic test pressure of 150-lbs. per square inch and maintained without pressure loss for a minimum of four (4) hours. No caulking of joints will be permitted. Any joint found to leak under this test shall be broken, remade and a new test applied.

E. The roof drain piping system shall be tested in the following manner: Plug pipe outlet and fill entire under floor system with water under a 10-foot head above finished floor and sustain a constant level for a

minimum period of three (3) hours. All piping above the lowest floor level shall be tested from a test tee installed at that level with the entire system filled with water into drain body and sustain the constant level for a period of three (3) hours.

F. The Contractor shall furnish all necessary equipment, materials and labor to perform the above-specified tests.

220020 STERILIZATION

A. All new water piping shall be charged with a chlorine solution containing not less than 50-ppm available chlorine. The solution shall remain in the piping for a minimum period of 6 hours, during which time valves shall be opened and closed to permit a small flow of the solution. At the end of the six (6) hours, the solution shall be tested and must contain a residual of at least 5 to 10 ppm chlorine. The system shall then be drained and flushed to provide satisfactory potable water before final connection is made to the existing distribution system.

B. The Contractor shall contract with an independent Testing Laboratory for a certification letter that the system sterilization meets or exceed standards for potable water.

220021 PLACING IN SERVICE

A. Upon completion of the entire system installation, the entire system and all equipment shall be tested by actual operation to provide that it will function as intended.

B. The Contractor shall flush all waste piping prior to final connection to existing system, to ensure that no foreign materials are in these lines, and that a continuous flow of water and waste can be affected.

C. The Contractor shall flush all water piping prior to the connection of faucet aerators to provide a clean and operational water system.

D. The Contractor shall place the entire system in a satisfactory operating condition and shall furnish all assistance and instructions required by the Owner's representative during initial operating period. The Contractor shall acquaint the Owner's representative with the special parts required for the operation of the flush valves furnished and installed on the project.

E. It is the Contractor's responsibility to turn over to the owner all fixtures and floor drains in a clean condition.

220022 ELECTRICAL WIRING

A. The Electrical Contractor shall furnish all disconnects and motor starters and wire and make all final electrical connections to equipment provided under Division 22. See Electrical Drawings.

220023 OPERATING AND MAINTENANCE MANUAL

A. Four (4) complete sets of all operation and maintenance manuals **shall** be delivered by the Contractor to the Owner thru the Architect two (2) weeks before the pre-final inspection is held. The manuals **shall** be installed in 3-ring hard cover heavy duty notebooks with the name of the project and the words "**Operation and Maintenance Manual**" permanently affixed to the **cover** and **spine**. All items for the project shall be separated by identification tabs correlated to the index. The manuals **shall** contain the following items as a minimum:

1. Index and page number.
2. Certificate of substantial completion.

3. A summary sheet of warranties with dates noted and a copy of all warranties.
4. List of subcontractors and suppliers with names, addresses, and phone numbers.
5. Water Line test data for sterilization.
6. Complete start-up, operation, and shutdown procedures for each system including sequence of events, locations of switches, emergency procedures, and any other critical items
7. Lubrication schedules and types of lubricants.
8. Complete set of current shop drawings and equipment description showing all capacities and other operation conditions.
9. Equipment summary showing all capacities and ratings (HP, KW, etc.).
10. Operation manuals, installation manuals, and parts list for all installed equipment.
11. All submittal data indexed with tabs and shop drawings.

B. One copy shall be manufacturer's original published literature with manufacturers name on all items. ***FAXED COPIES WILL NOT BE ACCEPTABLE***.

220024 AS BUILT DRAWINGS

A. The General Contractor and Plumbing Contractor, shall maintain "during the course of the work" a set of drawings marked up to show the work as installed, including dimensions to and elevations of buried work. Both Contractors shall initial and date all changes to the contract drawings. The Architectural Observer may check this set of documents monthly for compliance. Upon completion of the work, return this set of drawings to the Architect.

220025 FIXTURES

A. All exposed piping and metal parts shall be chrome plated. Slip joints will not be permitted except on fixture side of trap.

B. **MANUFACTURERS MODEL NUMBERS ARE PROVIDED FOR GENERAL INFORMATION ONLY.** Description of product shall take precedence over model numbers.

C. All floor drains shall have a deep seal cast iron P-trap installed below floor as a separate item.

D. All counter mounted fixture rims shall be sealed with clear "G.E. Silicone Seal" caulking.

P-1 COUNTER SINK: (Handicapped) 22" x 19" x 4-1/2" deep single compartment, self rimming, 18-gauge, type 304 nickel bearing stainless steel with backledge, sound deadening applied to under side, rear center drain outlet shall be Elkay LRAD2219-4.5 or Just SL-ADA-1921-A-GR-4.5 GR or approved equal by Advance Tabco. Stainless steel crumbcup strainer with 1-1/2" offset tailpiece shall be Elkay LKAD35 or Just J-ADA-35 GR or approved equal by Advance Tabco. Lead-free hot and cold water supply faucet with renewable cartridge, swing spout, 0.5 GPM soft flow aerator, less spray, shall be Chicago 895-L9E72ABCP, or approved equal by Zurn. 1/2" sweat x 1/2" compression sink supply stops shall be equipped with 5" extension, wheel handle ball valve angle stops shall be McGuire BV170, Zurn Z8808Q-PC, or approved equal by Brasscraft. 1-1/2" x 1-1/2" chrome plated adjustable cast brass P-trap with 1-1/2" slip joint inlet, cleanout, and 1-1/2" 17-gauge tube outlet shall be McGuire No. 8912C, Zurn Z-8702-9LC-PC-B-CE or Kohler K-9000. Install cast brass escutcheons with setscrew on all piping entering base cabinet.

P-2 ICE MAKER CONNECTION BOX: Fully recessed unit with lead free cold water shut-off valve, compression nut and ferrule as shall be LSP Products Group model OB-801, IPS Corporation model AB9700 or approved equal Oatey Company.

P-3 WALL HYDRANT: Non-freeze type with 3/4" copper inlet, 3/4" vacuum breaker hose end, removable key handle, self draining, for 12" wall thickness as required, Woodford Model 67, Zurn Model Z-1310 or Josam Model 71050-12.

P-4 FLOOR DRAIN: 12" x 12" square cast iron floor drain with adjustable top, anchor flange, extra heavy duty heel proof nickel bronze grate rated for 7,500 lbs., Watts FD-460-1, or approved equal by Zurn or J.R. Smith.

P-5 WATER HEATER: Shall be electric instantaneous type, 5,540 watt immersion heating element, with microprocessor controlled outlet temperature. Thermostat shall be factory set for 110 degrees. Heater shall be wired for 277-volt, single-phase operation and shall be Chronomite Laboratories, Inc. Model SR-20L/277, or approved equal by Eemax or Stiebel.

P-6 HUB DRAIN: Provide 3" I.D. cast iron hub drain for condensate collection from HVAC equipment. Hub drain shall have p-trap below slab and shall extend to 1" above finished floor. Pipe material shall be per condensate drainage section of these specifications. Support shall be per hangers section of these specifications.

220026 GUARANTEE

A. Guarantee: The Contractor shall guarantee the entire plumbing system subject to the General Conditions of these specifications.

220027 BIDDING PROCEDURE

A. The Contractor shall provide bidding for Alternate Bids in accordance with Division 01. Contractor shall refer to Division 01 for any required unit prices and allowances.

END OF SECTION 220000

SECTION 230500 - HEATING AND AIR CONDITIONING

230501 GENERAL

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The Heating and Air Conditioning Contractor shall cooperate with the contractors of other trades and shall install his work as fast as the progress of the balance of the work will permit.

C. See Section 013100 for requirements for Coordination Drawings.

D. The Heating and Air Conditioning Contractor shall install all work in accordance with the requirements of the latest edition of the North Carolina State Building Code. Codes to be a part of these specifications: North Carolina State Building Code, National Fire Protection Association Codes Section 70, 90A, 91, and other applicable sections.

E. The drawings accompanying these specifications indicate diagrammatically the general location of the ducts, piping, and equipment and do not show all offsets, supports, fittings, bolts, connections, etc., required for a complete system. While the drawings are to be followed as closely as possible, if it is found necessary to change the location of same to accommodate the conditions at the building, such changes shall be made without additional cost to the Owner, and as directed by the Engineer. Any detail which is omitted, and which is necessary for the proper operation of any system included under the contract, shall be supplied and installed by the Heating and Air Conditioning Contractor without extra cost to the Owner. All pipes and ducts shall be run as high as possible to maintain ceiling and head clearance. All equipment shall be installed in such a manner as to allow proper maintenance access.

F. Equipment and Materials shall be delivered to the site and stored in original containers, suitably sheltered from the elements, but readily accessible for inspection by the Engineer until installed. All items subject to moisture damage shall be stored in dry spaces.

G. Conditions shall be checked at the building before placing orders for apparatus and such apparatus shall be of such dimensions as to fit the spaces allotted. The Heating and Air Conditioning Contractor shall not scale mechanical plans, but rather refer to architectural plans for dimensions.

H. All debris resulting from heating and air conditioning work shall be removed from the premises daily or as directed by the Engineer. Trash and rubbish shall not be allowed to accumulate either within or outside the building. Materials and debris, which in the opinion of the Engineer cannot practicably be removed from the site the same day, may be temporarily stacked or stored in a designated location on the site as directed by the Engineer.

I. Guards shall be provided for all moving equipment, motor couplings, pump shafts, belt drives and similar exposed reciprocating or rotating components.

J. All HVAC and refrigeration equipment shall be labeled in accordance with Section 301 of the North Carolina Mechanical Code and as required by the Authority having jurisdiction. Labeling shall be a permanent factory-applied nameplate affixed to the equipment on which shall appear in legible lettering, the manufacturer’s name or trademark, the model, serial number, and the seal or mark of the testing agency.

230502 SCOPE

A. The Heating and Air Conditioning Contractor shall provide labor and materials required for a complete system ready for operation as shown on the drawings and hereinafter specified. This includes all

equipment, ductwork, necessary plumbing, and all other services necessary whether they are specifically mentioned herein or not. The entire installation shall be installed in a first-class, neat, professional manner to the satisfaction of the Engineer and shall conform to all applicable codes and laws.

230503 DEMOLITION

A. General Requirements: The work includes the demolition or removal of all construction indicated, specified, or necessary to accomplish the work under this contract. All items not to be reused shall become the property of the Heating and Air Conditioning Contractor. The drawings define the scope of work, but it is not intended that all items of demolition work be specifically indicated. After carefully reviewing the drawings and specifications to determine intent, and prior to bidding, the Heating and Air Conditioning Contractor shall visit the site and determine the extent of demolition work required to properly complete the work under his contract.

B. Protection of Materials and Work: Before beginning any cutting or demolition work, the Heating and Air Conditioning Contractor shall carefully survey the existing work and examine the drawings and specifications to determine the extent of work required. The Heating and Air Conditioning Contractor shall take all necessary precautions to insure against damage to existing work to remain in place, to be reused, or to remain the property of the Owner, and any damage to such work shall be repaired or replaced at no additional cost to the Owner.

C. The Contractor shall notify the Owner immediately in the event that any asbestos or hazardous containing materials are encountered during demolition.

230504 SHOP DRAWINGS AND SUBMITTAL DATA

A. The Heating and Air Conditioning Contractor shall submit within 10 days after award of the contract a list of materials and the manufacturer to be used on this project. He shall submit within thirty days after award of the contract at least five copies of submittal data in written form for the Engineer's use in approving materials and equipment. One copy will be returned. If the Heating and Air Conditioning Contractor desires the return of more than one copy, additional copies shall be provided to the Engineer at the time of the original submission. It is requested that all submittal data be sent to the Architect at one time. Unless special consideration is given, none of the submittal data will be checked until it has all been received by the Architect. Where called for, the Heating and Air Conditioning Contractor shall submit five sets of shop drawings showing the detailed arrangement or connections that are shown schematically on the drawings. Data certified for the specified project and indicated manufacturer, type, or size, capacity, etc., shall be submitted for the following equipment items:

1. Blower Coil Air Handling Units
2. Power Ventilators
3. Diffusers, Grilles, and Registers
4. Pumps
5. Heaters
6. Valves
7. Controls with Complete Diagram
8. Water Treatment and Feeder System
9. Fire, Manual, and Motorized Dampers
10. Access Doors
11. Insulation
12. Vibration Isolation
13. Through-Penetration Firestop Details
14. Testing and Balancing
15. Coordination Drawings per Section 013100

230505 APPROVED EQUAL EQUIPMENT, ETC.

A. Manufacturers listed are to establish a standard of quality and not intended to limit the selection to these manufacturers. All materials and equipment which are essential and have not been specified or shown shall be new and of the highest grade and quality, free from defect or other imperfections. It should be understood that where the word "provide" is used, it is intended that the Heating and Air Conditioning Contractor shall purchase and install all materials required. Approval of equipment will not relieve the Contractor of compliance with the specifications even if such approval is made in writing, unless the attention of the Engineer is called to the non-complying features by letter accompanying the submittal data. Approval of submittal data by the Engineer shall not be construed as a complete check of approval of detailed dimensions, weights, gauges, and similar details with the proposed articles. The conformance with the necessary coordination between the various other contractors and suppliers shall be solely the responsibility of the Heating and Air Conditioning Contractor.

230506 BLOWER COIL AIR HANDLING UNITS

A. Units shall be vertical or horizontal air handling unit as indicated on the drawings with airflow data certified in accordance with AHRI Standard 430. Units shall be listed and labeled by a nationally recognized independent testing agency and be compliant with NFPA90A. Air handler shall consist of hydronic coils, drain pan, centrifugal fan with motor, and filter section in a common cabinet. Motor location and coil connections shall be independent for the same or opposite side locations. All units shall be shipped and stored stretch-wrapped for protection. The units shall be Trane Model BCVD/BCHD, Carrier, York, or approved equal.

B. Casings (structural components) shall be constructed of 18-gauge galvanized steel, internally insulated throughout with 1" 2.0 lb/cu. Ft R-Value of 4.3 density glass fiber with foil facing. Insulation shall be UL listed and meet NFPA-90A, UL 181 and bacteriological C665 standards. Panels shall be removable for servicing and removal of fan, coils and drain pan. Panels shall be on both sides of the unit.

C. Heating and cooling coils shall be slab-type with aluminum fins mechanically bonded to seamless copper tubes factory air tested at 450 PSIG. Maximum standard operating conditions shall be 300 PSIG at 200.0 degrees F. Coil performance data shall be rated and certified in accordance with the current edition of AHRI standard 410. See Unit Schedule on drawings for coil positions.

D. Slab coils shall have factory mounted temperature sensor between the coils. Coordinate sensor requirements with Section 230900 Instrumentation and Control for HVAC for proper communication signal with the BAS.

E. Unit's drain pan shall be stainless steel noncorrosive double-sloped to allow positive condensate drainage. Coils shall mount above the drain pan, not in the drain pan. Drain pan shall be removable for cleaning. Drain pan connections shall be stainless steel pipe. Pan shall have main drain and auxiliary drain connections.

F. Fans shall be DWDI (double width double inlet) forward curved centrifugal blower type direct drive mounted directly to the motor shaft. All fans shall be dynamically balanced. All air handlers shall have a single fan. Fans may be belt drive with adjustable variable pitch sheaves selected at a minimum service factor of 1.2.

G. Motors shall be electronically commutated motors (ECM) factory programmed run tested in assembled units. The motor controller shall be mounted in control box with a built in integrated user interface and LED tachometer. For adjustments, motor parameters shall be adjusted through momentary contact switches accessible without factory service personnel on the motor control board. Motors shall soft ramp between speeds to lessen the acoustics due to sudden speed changes. Motors shall be capable of being operated at three speeds. All motors shall have integral overload protection with maximum ambient

operating temperature of 130.0 degrees F and use permanently sealed ball bearings. Motors shall operate at plus or minus 10 percent of rated voltage on all speed settings.

H. Sections with angle filter mixing box shall have hinged access doors with cam lock latches on both sides for filter replacement. No tools shall be required for access or filter removal. Air filters shall be 2" UL Class 1 pleated panels with Minimum Efficiency Reporting Value of MERV 8 per ASHRAE Standard 52.2-1999. Contractor shall supply complete sets of filters to protect his equipment during construction, changes of filters at testing and balancing, another change of filters at completion, and leave one additional complete set of filters at the school for the next change. Filters shall have a face velocity not to exceed 300 feet per minute. Provide factory supplied fixed filter blockoffs to prevent air bypass around filters.

I. Dampers, where provided in air handling unit's filter/mixing box section in lieu of in ductwork, shall be opposed blade type with metal compressible jamb seals and extruded vinyl blade edge seals with a maximum leakage rate of 4 cfm/sf at one inch water gauge when tested in accordance with AMCA Standard 500-D.

230507 POWER VENTILATORS

A. Power ventilators shall be tested and rated in accordance with the standards of AMCA 210 and shall carry the AMCA seal. All fans shall be UL labeled. Fans shall be Cook, Greenheck, Carnes, PennBarry, Twin City, or approved equal.

B. In-line fans shall be centrifugal in-line ventilator with variable speed belt drive or direct drive as indicated on the drawings. Housing shall be constructed of steel with removable drive door and access panel. Wheel shall be dynamically and statically balanced. Motor base shall be adjustable and have locking screws and guides to provide positive belt tension and correct alignment. Ball bearings shall be heavy-duty self-aligning, relubricable flange type with locking collars. Bearings must be selected for 125,000 hours average service life at maximum cataloged operating speed. Drives shall be cast iron and have a minimum of 1.25 service factor. Drives shall be isolated from the airstream. Motors shall be EISA 2007 NEMA premium efficiency with efficiency rating stamped on motor nameplate. For in-line fans served by variable frequency drives, fan motors shall be EISA 2007 NEMA premium efficiency, inverter duty type per NEMA MG 1 with Class F insulation. All units shall be provided with backdraft dampers, hanging vibration isolators, motor/drive guards, and disconnect switches. Direct drive units shall have solid-state motor speed controllers with an "OFF" position.

230508 DIFFUSERS, GRILLES, AND REGISTERS

A. Diffusers, Grilles, and Registers shall be as manufactured by Metal Aire, Titus, Krueger, Price, or approved equal unless otherwise noted.

B. All diffusers, grilles, and registers shall have a maximum NC level of 25 in the space for the specified airflow, and shall have factory applied white baked enamel finish. Where indicated on drawings to be field painted, white factory finish shall be as necessary to receive field finish painting.

C. Lay-In Supply Air: Shall be steel construction, fixed square louvered face, 4-way blow, panel type to drop in 24" x 24" "T" bar ceiling grid, with adjustable vertical pattern. Vertical air adjustment shall be made by adjusting four perimeter blades to force air down in the vertical position.

D. Regular Ceiling Supply Air: Shall be steel construction square, fixed square louvered face, 4-way blow, with adjustable vertical pattern and opposed blade damper for balancing. Pattern adjustment shall be the same as for lay-in supply air diffusers.

E. Sidewall Linear Bar Grille: Shall be extruded heavy duty aluminum bar blades locked into extruded aluminum border. Blades shall be fixed 15° deflection on 1/2" centers running parallel to the long dimension of the grille with reinforcing support bars. Border shall be 1" width suitable for sidewall mounting complete with precise factory mitered corners and concealed mounting. Border and blade factory finish shall be powder coat of color selected by Architect. Provide factory-insulated plenum box.

F. Spiral Duct Air Nozzle Panel – Panel shall be heavy gauge aluminum with foam gasket, high velocity, low noise level curve frame series air nozzle panel with 4 air nozzle diffusers. Provide direction air pattern control up to 35-degree deflection and 360-degree rotation. Curve to match the duct diameter and provide an extractor damper.

G. Slot Diffuser: Supply air slot diffuser shall be complete with factory installed fully adjustable dual air pattern vanes and factory-insulated plenum. The diffuser shall be constructed of 24-gauge galvanized steel and internally insulated with 1/2" thick, 4-lb./ft^3 density fiberglass insulation. The plenum shall be constructed of 24-gauge galvanized steel. All exposed surfaces shall be painted with a white baked enamel finish. The diffuser when shown to be mounted in a lay-in ceiling shall be designed to straddle ceiling tee and have appropriate factory-made notches to accommodate crossing of ceiling grid tees and provided with cable operating inlet dampers. The air slots shall be designed for horizontal coanda flow. See Schedule on drawings for size, quantity, and blow direction of slots. Return air slot grille shall be the same as supply air slot diffuser without adjustable dual air pattern vanes and without cable operating inlet dampers.

H. Lay-in Ceiling Return Air Grille: Shall be aluminum 1/2" x 1/2" egg crate, steel frame, and designed to lay in an inverted "T" bar ceiling grid. Grilles shall be full flow across the entire face of grille and tapered up to neck size.

I. Ceiling Return Air Grille: Shall be aluminum 1/2" x 1/2" egg crate with removable face, steel frame and opposed blade dampers. Registers shall be full flow across the entire face of register and tapered up to neck size and provided for surface mounting with border and factory mitered corners.

230509 PUMPS

A. Vertical inline pumps shall be non-overloading centrifugal type with flanged connections. Pump shall have internally flushed mechanical seals, oil lubricated sleeve bearings, and bronze impeller. Motors shall be rated NEMA Premium Efficient and comply with EISA 2007 and shall have efficiency rating stamped on motor nameplate. All three phase motors shall have phase loss protection. The entire pump shall be designed and guaranteed for the intended application and shall be Bell and Gossett, Taco, Grundfos, or Armstrong.

230510 HEATERS

A. Propeller unit heaters shall have 18-gauge steel casing, coil, fan, and motor in horizontal or vertical discharge configuration as indicated on the drawings with adjustable discharge louvers, ceiling mounts, combination fan guard and motor mount complying with UL 2021.

1. Casing shall have manufacturer's standard baked enamel finish applied to factory-assembled and -tested propeller unit heaters before shipping.
2. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.
3. Hot-Water Coil: Copper tube, minimum 0.025-inch wall thickness, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 325 deg F, with manual air vent. Test for leaks to 350 psig underwater.
4. Test and rate hot-water propeller unit-heater coils according to ASHRAE 33.
5. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

6. Motor: Permanently lubricated, multispeed.
7. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers.
8. Electrical components, devices, and accessories shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application. Built in contactors with 24 volt control circuit, built in fuses, built in thermal overload protection shall all be included.
9. Unit heaters shall be Trane, Modine, Reznor, Sterling, or approved equal.

B. Electric unit heaters shall be listed by Underwriters Laboratories, Inc., and shall bear the appropriate UL label. Heaters shall be furnished and installed in accordance with the manufacturers' published recommendations. The elements shall be metal sheath fintube type. Heaters shall be complete with adjustable discharge louvers, ceiling mounts, built-in contactors with 24 volt control circuit, built-in fuses, 18 gauge steel cabinet, built-in thermal overload protection, combination fan guard and motor mount, continuous duty motor, unit mounted thermostat, and separate field installed-unit mounted power disconnect switch. Unit heaters shall be Markel Series 5100, Trane, Raywall, Indeeco, or approved equal.

230511 VALVES

A. Valves shall be furnished as specified and as shown on the plans. All valves shall have manufacturer's metal identification disc under the handle nut. Provide valve extension handles for all valves in chilled water piping systems. Seats for iron body valves shall be renewable. Valves shall be by a single manufacturer unless noted otherwise. Provide a 3/4" diameter dot on lay-in ceiling grid below all valve locations. Dot color shall be same as that color specified hereinafter for that piping's finish painting. Provide 19 gauge polished brass valve tag on all valves. Heating and Air Conditioning Contractor shall furnish valve schedule mounted under glass in a frame in the main mechanical room.

B. Check valves up to 2" shall be bronze body swing check with Teflon disc and stainless trim. Check valves 2-1/2" and over shall be the wafer non-slam type with ductile iron body, 316 stainless steel trim, bronze bushings, and bronze seats.

C. Ball valves shall have bronze body, synthetic rubber seat rated at 250°F, ball and seat and indicating dial with memory stop. Valves on chilled water systems shall have stem extensions for insulation coverage.

D. Butterfly valve shall have ductile iron lug body, aluminum bronze disc, synthetic rubber seats rated at 250°F, ductile iron or aluminum lock handle with memory stop. Valves 4" and larger shall be equipped with gear operator with handwheel. All gear operators shall have traveling indicator and adjustable stops. Valves on chilled water and condenser water systems shall have stem extensions for insulation coverage.

SIZES UP TO AND INCLUDING 2" BRONZE BODY SCREW IN

	BALL	CHECK
Hammond	8201	IB 946
Nibco	T-580	T-433-Y
Milwaukee	BA-200	510T

SIZES 2-1/2" AND OVER FLANGE CONNECTED IRON BODY

	CHECK	BUTTERFLY
Hammond	9354	6200
Nibco	F-910	LD-3100
Milwaukee	1800	ML-122B

E. Multipurpose valves shall be straight pattern design to perform functions of non-slam check valve, throttling valve, shutoff valve and calibrated balancing valve. Valve shall be cast iron suitable for 175

PSI working pressure with bronze seat, replaceable bronze disc with EPDM seat insert, stainless steel stem, and chatter preventing stainless steel spring. Valves shall be Bell and Gossett, Armstrong, or Taco.

F. Automatic Flow Control Valves:

1. Manufacturers: Flow Design, Inc., Autoflow, Griswold, Bell & Gossett, PRO Hydronic Specialties, Nexus, or approved equal.
2. Design:

a. Valves shall be pressure independent type within operating pressure range.
b. The GPM for the automatic flow control valves shall be factory set and shall automatically limit the rate of flow to within 5% of the specified amount.
c. The 1/2" - 2", the flow cartridge shall be removable from the Y-body housing without the use of special tools to provide access for regulator changeout, inspection, and cleaning without breaking the main piping. (Access shall be similar to that provided for removal of a Y-strainer screen).
d. True operating ranges of 2-32 PSID or 5-60 PSID are required. The design flow should be achieved at the minimum PSI differential. A 50% safety factory applied to the lower operating range is not acceptable.
e. Each valve shall have two P/T ports.
f. All automatic flow control devices shall be supplied by a single source and certified flow tests, witnessed by a Professional Engineer, shall be available.
g. Five-year product warranty and free first year cartridge exchange.

3. Construction:

a. The internal wear surfaces of the valve cartridge shall be electroless nickel or stainless steel.
b. The internal flow cartridge body shall have machined threads so the spring free height may be compensated for without the use of fixed shims. A crimpled sheet metal design is not acceptable.
c. The internal flow cartridge shall be permanently marked with the GPM and spring range.
d. For 1/2" through 2" pipe sizes: An assembly shall consist of a brass Y-type body, integral brass body ball valve and “O” ring type union.
e. For 2-1/2" and larger flanged connections: Ductile iron body suitable for mounting wafer style between standard 150# or 300# flanges. The long flange bolts and nuts shall be provided with each control valve.
f. All valves shall be factory leak tested @ 100 PSI air under water.
g. Valve bodies shall have flow direction indicated.
h. Valves shall have attached and permanent labels indicating unit served, flow rate, pressure control range, manufacturer, and model number.

4. Minimum Ratings:

a. 1/2" through 2" pipe size: 400 PSIG at 250°F.
b. 2-1/2" through 14" pipe size: 600 PSIG at 250°F.
c. 16" through 30" pipe size: 250 PSIG at 250°F.

5. Flow Verification:

a. As part of testing and balancing, the differential pressure across the Automatic Flow Control Valve shall be measured for flow verification and to determine the amount of system over heading or under pumping.
b. The flow shall be verified by measuring the differential pressure across the coil served or the wide-open temperature control valve and calculation the flow using the coil or valve Cv.

6. Test Kit: A differential test kit shall be supplied to the Owner by the Heating and Air Conditioning Contractor to verify flow and measure overheading. The kit shall consist of a 4-1/2" diaphragm gauge equipped with ten-foot hoses and P/T adapters all housed in a vinyl case with instructions. Calibration shall be 0-35 PSID for 2-32 PSI spring range or 0-65 PSID for 5-60 PSI range.

7. Installation:

   a. Install automatic flow control valves on the return lines of coils, etc. as indicated on the plans. Balancing valve on supply side is not acceptable.
   b. The standard ports and handles shall clear 1" thick insulation. Handle and port extensions are required and shall be provided for over 1" thick insulation. Coordinate with insulation thickness schedule indicated on the drawings.
   c. Install, on the supply side of coils, a Y-strainer with a brass blowdown valve with 3/4" hose end connection with cap and chain.
   d. Flow control valves shall be 5-60 PSID range.

230512 CONTROLS

A. See Section 230900 Instrumentation and Control for HVAC.

230513 WATER TREATMENT AND FEED SYSTEMS

A. **Heating and Air Conditioning Contractor shall provide flushing of new piping and new equipment. Chemical treatment and chemicals shall be by the Airport's Chemical Treatment Contractor.**

B. Flushing and Clean-Out:

1. Prior to extended operation and connection to equipment and coils, all new piping systems shall be flushed with clean water and the strainers cleaned at least three times to remove foreign matter and as coordinated with the Airport's Chemical Treatment Contractor. Flow rates in sections being flushed shall be 6 feet per second minimum. All strainers at equipment shall be periodically checked and cleaned until flushing operations reveal the absence of foreign materials.
2. Notify Architect and Engineer 48 hours in advance of all flushing and strainer cleaning so that it may be witnessed.

C. Hydronic Piping Systems Chemical Treatment – Chilled Water and Hot Water Systems:

1. By Owner's Chemical Treatment Contractor.

D. Test Reports:

1. Submit water treatment test reports in typewritten form documenting acceptable flushing and treatment, and hydronic piping systems chemical treatment.

230514 FIRE, MANUAL, AND MOTORIZED DAMPERS

A. Fire dampers shall be provided in the duct systems in accordance with NFPA Standard No. 90A and shall conform to NFPA Standard No. 90A for materials and workmanship. The dampers shall be spring loaded dynamic rated multi-leaf type UL approved and labeled for installation into the rated assembly (a 1-1/2 hour damper for a 2 hour rated assembly and two 3 hour dampers for a 4 hour rated assembly) and shall be installed according to the manufacturer's recommendations. Dampers shall be Ruskin, Pottorff, Prefco, Air Balance, United Enertech, or approved equal.

B. Manual and Motorized dampers shall be low leakage type provided in the duct systems as indicated on the drawings in accordance with NFPA Standard No. 90A and shall conform to NFPA Standard No. 90A for materials and workmanship. Blades shall have extruded vinyl double edge seals. Jambs shall have flexible metal compression type seals. Maximum damper leakage shall be 0.5% at pressure differentials under 4.0 in w.g. Leakage ratings shall be when tested in accordance with AMCA Standard 500. Motorized dampers shall have electric operators and shall be normally closed, unless indicated otherwise on the drawings. Wiring to operators shall be by the Heating and Air Conditioning Contractor. Manual dampers shall have handle and locking quadrant. To facilitate service access and insulation installation,

manual damper handles shall be on 2" stand-off brackets. Handles shall be spray painted red. Dampers shall be installed according to the manufacturer's recommendations. Dampers shall be Ruskin, Pottorff, Prefco, Air Balance, United Enertech, or approved equal.

230515 ACCESS DOORS

A. Access doors shall be provided for access to all fire and motorized dampers, duct mounted smoke detectors, and duct systems as necessary.

B. Duct mounted access doors shall be constructed of No. 22 US gauge zinc-coated sheet steel and shall be gasketed, air tight and provided with not less than two (2) cam-type latches. Doors shall be square and shall be 12" x 12" or two inches less than the height of the duct. Doors shall be two-piece with 1" rigid insulation between the metal sides. Doors shall have engraved plastic laminated labels with 1/2" tall letters indicating item accessed through door.

C. Wall and ceiling access doors shall be provided as specified in Section 083113.

D. Provide 3/4" diameter red dot on ceiling grid below all duct access doors.

230516 ELECTRICAL

A. Electrical circuit sizes are based on capacities of the drawings and it shall be the responsibility of Heating and Air Conditioning Contractor to change any and all electrical work in order to fit mechanical equipment. Heating and Air Conditioning Contractor shall coordinate with Electrical Contractor to assure that all units are properly connected and shall check wiring prior to starting units. Any damage to units resulting from improper wiring or connections shall be the responsibility of Heating and Air Conditioning Contractor. Flexible electrical conduits shall be 18 inches in length maximum. All electrical work shall be installed in accordance with codes having jurisdiction and the Electrical Division, Division 26, of these specifications. Termination of electrical power wiring to mechanical equipment shall be as detailed on the drawings and per Division 26.

B. Starters shall have integral 120V Control power transformer. Starters shall have holding coil for 120V control with hand-off-auto switch. The starters shall be inoperative if the thermal unit is removed. All magnetic starters shall be NEMA sized with applicable melting alloy overload relays and applicable enclosure. Starters shall be G.E. or approved equals by Allen-Bradley, Square D, Siemens or Cutler-Hammer.

C. All three phase motors shall be provided with phase loss protection.

D. Fused disconnect switches shall be heavy duty industrial type. Switches shall be Siemens, General Electric Company, Square D or Cutler-Hammer fusible type mounted so handle is approximately 4 feet 0 inches above floor or grade. Switches shall have a factory applied standard finish and the usage or designation shall be indicated on cover with engraved plastic laminated labels with 1/2" high contrasting letters. Each switch for motor circuits shall have a complete set of time delay fuses.

E. Motor Starters and Fused Disconnect Switches shall be neatly arranged, and securely fastened to walls with expansion bolts, lead shields, etc. Each starter or switch shall have its usage or letter designation indicated on its cover with engraved plastic laminated labels with 1/2" high contrasting letters. Where connections are made to motors not near walls or columns, a vertical conduit attached to floor and ceiling shall be installed and the wiring carried in and out of this conduit by means of condulets. An 18-inch length of flexible metallic conduit shall be installed in the circuit to each connection to a motor. Liquid tight shall be used in all wet locations. Grounding wire shall run inside of flexible conduit.

230517 DUCTWORK

A. Mechanical drawings are schematic only and do not show all offsets etc. required. Heating and Air Conditioning Contractor shall familiarize himself with the complete contract documents and site conditions before fabricating ductwork. Any changes to ductwork found necessary to accommodate the conditions at the building shall be made without additional cost to the Owner, and as directed by the Engineer.

B. During construction, interior of ductwork shall be protected. All open ends of ductwork shall be covered with self-adhesive 3 mil polyethylene film.

C. Ductwork shall be of galvanized steel with standard gauges and construction in accordance with the recommendations of SMACNA HVAC Duct Construction Standards, Metal and Flexible, Third Addition, 2005 for appropriate pressure class. Airfoil turning vanes with 1-1/8" spacing and rail support system shall be installed in all 90º elbows. Ductwork shall be cross broken on all sides and shall be supported at both ends of each joint and at 10'-0" intervals maximum with galvanized angles supported by galvanized threaded rods of sizes and spacing in accordance with SMACNA. Ductwork to be exposed shall be constructed in a first class, neat, professional manner and exposed ductwork with excessive hammer marks shall be replaced. Round supply takeoffs from trunk ducts shall be made with factory 45º entry branch rectangular to round type fittings. Provide dampers in takeoff fittings where indicated on drawings. Damper handles shall be on 2" stand-off brackets. Handles shall be spray painted red. Splitter dampers shall be provided where indicated with adjustment quadrant locking device and shall be constructed of two thicknesses of 24-gauge-galvanized steel. All dimensions on the drawings are free inside dimensions. All components of the air distribution system shall be mechanically fastened with at least three equally spaced sheet metal screws with screws not more than on 12" centers. All duct joints shall be sealed in accordance with SMACNA Seal Class A before insulation is applied. All sealants shall meet the provisions of UL181.

D. Spiral ductwork shall be round, 18-gauge spiral lockseam single wall construction with flanged joints, paint-grip finish to receive painting by the General Contractor. Provide factory angle trim ring at wall penetrations. Duct shall be fastened using sheet metal screws only and no duct tape. Dents in ductwork will not be acceptable and ductwork shall be replaced by the Heating and Air Conditioning Contractor. Diffuser, register, and grille openings shall be single wall and made at the factory ready for the air distribution device.

E. Final 8'–0" of the runout to the air outlet may be factory fabricated flexible ducts complying with NFPA Standard No. 90A, UL 181, and shall be UL Class 1 R-6 insulated type with foil vapor barrier. The flexible duct shall be air tight for factory test when bent to full recommended radius and under not less than 10" water gauge internal pressure and shall be limited to 8'-0" maximum length. Flexible ducts shall be supported by galvanized steel straps in accordance with SMACNA at intervals not exceeding 4'-0" and at each change of direction. Flexible ducts shall have a minimum of one support.

230518 PIPING

A. The Heating and Air Conditioning Contractor shall furnish all piping and supports necessary to provide a complete system as shown or intended by the plans and specifications. All piping shall be inspected, tested, and approved before being insulated or concealed. Piping 2" and smaller shall be welded or have screwed fittings with extra heavy nipples, unless otherwise noted. Piping 2-1/2" and larger shall have welded fittings of the same material and weight as the piping in which they are installed. Pipe shall be clean, run generally parallel to the building and have all open ends closed with iron caps at all times. Eccentric reducers shall be used in horizontal runs and concentric reducers in vertical runs. All piping and fittings shall have manufacturer’s identification and ASTM designation incorporated thereon.

B. Chilled water and hot water system piping shall be standard weight Schedule 40 black steel in accordance with ASTM Specification A-53. All fittings shall be Schedule 40. Piping 1" and smaller

may be Type L copper with joints soldered with 95-5 solder. Copper piping shall have dielectric union or bronze ball valve at connection to ferrous pipe.

C. Drain pan condensate and pumped condensate piping above slab shall be Type L copper with all joints soldered with 95-5 solder. Piping shall have dielectric union at connection to ferrous pipe. Drain pan condensate piping shall have a minimum slope of 1/4" per linear foot, and shall be at least as large as unit condensate connection.

D. Welding material and labor shall be in accordance with welding procedures of the American Standards Code for Pressure Piping ASA B31.9. Welders shall be fully qualified in above specified procedure, tested, and so certified by an approved Welding Bureau of Locally Recognized Testing Authority. Welding shall be electric arc or oxyacetylene welding method as approved using electrodes and rods that comply with ASTM specifications.

E. Swing joints or loops shall be provided wherever necessary to allow for expansion of piping. Broken piping or fittings shall be removed and replaced at the Heating and Air Conditioning Contractor's expense.

230519 PIPE HANGERS

A. All piping shall be neatly and securely supported by hangers from fire resistance rated structural elements of the building spaced in the following manner:

1. Steel Piping 1-1/4" and smaller - 7'-0" O.C.
2. Steel Piping 1-1/2" and larger - 10'-0" O.C.
3. Copper Piping 1-1/4" and smaller - 6'-0" O.C.
4. Copper Piping 1-1/2" and larger - 10'-0" O.C.
5. Provide 2 hangers at each change in direction.

B. Hangers shall be the galvanized clevis type as manufactured by Modern Fig. 590, B-Line Fig. B 3100, or Grinnell Fig. 260 complete with galvanized hanger rods of size to conform to the type of hanger and pipe supported. Hangers shall be attached to the building by beam clamps or bolted to bar joist. At hangers provide 16" long 16 gauge galvanized sheet metal protection saddle three times the nominal pipe diameter. Under no condition shall hangers be connected directly to insulated pipe. Saddles shall be Modern Type A, B-Line Fig. B 3151, or Grinnell Fig. 167.

C. Hangers for vertical piping shall be galvanized riser clamp design as manufactured by Modern Fig. 500, B-Line Fig. B3373 or Grinnell Fig. 261. Riser clamps shall be installed on top of each floor penetration.

230520 INSULATION

A. All piping and ductwork shall be inspected and tested before insulation is applied. All insulation shall meet UL 723 and ASTM-E84 flame spread and smoke developed requirements of 25/50 and shall comply with NFPA 90A and the latest edition of the NC Building Code. Insulation shall be Certainteed, Owen Corning, Knauf, Johns-Manville, Trymer, Hi-Therm, or Dyplast.

B. All air conditioning supply, return, relief, and outside air ducts concealed above a ceiling and the back of all diffusers and grilles shall be externally insulated with 2" thick 1 lb. density foil scrim kraft jacketed insulation. Adhere insulation to duct with fire retardant adhesive in sufficient quantities to prevent sagging. Ducts with a width over 24" shall be further secured on all sides with mechanical fasteners on 18" maximum centers. Insulation shall be butted with facing overlapping all joints at least 2" and sealed with fire retardant vapor barrier adhesive. Tape all joints, breaks, punctures, and any penetrations with SMACNA foil faced kraft duct tape.

C. Where externally insulated ductwork is supported by angles, provide 6" long x duct width x 1-1/2" thick 6.0 pound density board insulation on bottom of duct at hanger support. External duct insulation shall be continuous around ductwork and board insulation at duct hanger. On round ducts, duct hanger shall be outside duct insulation.

D. All chilled water system supply and return piping, fittings, valves, etc., shall be insulated with rigid 2.3 lb/cubic feet polyisocyanurate insulation with a thermal conductivity of 0.19 btu-in/hr-ft^2-°F or lower at 75°F by ITW Insulation Systems, Dyplast Products, or Duna USA. Insulation and vapor retarder shall not exceed ASTM E-84 flame/smoke rating of 25/50. Provide Saran 540 vapor retarder film factory applied and Saran vapor retarder tape field applied. All butt and longitudinal joints shall be sealed. Fittings and valves shall be insulated with pre-formed phenolic fittings or mitered sections of pipe covering and covered with Saran 520 tape. Fiberglass fittings will not be permitted. Provide a 24" section of insulation for each pipe hanger to be installed by Heating and Air Conditioning Contractor at time pipe hanger and pipe are installed. Install insulation in such a manner as required to provide a complete vapor barrier. All piping and fittings shall be clean and dry prior to installation of the insulation. Piping insulation thickness shall be as shown in the schedule on the drawings. Piping exposed in occupied spaces or mechanical spaces shall have canvas jacket lagged in place for painting.

1. All insulation shall be tightly butted and free of voids and gaps. Vapor Retarder must be continuous. All fasteners and bands shall be neatly aligned and overall work must be of high quality appearance and workmanship.
2. In below ambient systems, staples, rivets, screws and other fasteners capable of penetrating the vapor retarder shall not be used.
3. Lap joint of vapor retarder to be sealed using SSL tape. Vapor retarder butt joints shall be covered with Saran 520 Vapor Retarder Tape.
4. Elbows and fittings shall be wrapped with Saran 520 Vapor Retarder Tape in a spiral fashion. Use a minimum amount of overlap between successive courses of spiral wrapped Saran Tape.
5. Insulation sections in hangar saddles shall be phenolic for pipes less than 16 NPS. At 10 feet hangar spacing and on pipes 16 NPS and larger, the bottom insulation sections in hanger saddles shall be 3.75 lb. per cubic foot rigid phenolic foam insulation for resistance to compression. Saddles shall wrap the insulation in an arc between 120° and 180°F depending upon the load.
6. When Saran vapor retarder film is used without PVC jacketing, a 1″-wide or greater filament tape or Saran 520 tape with a 25% (1-1/4 wraps) circumferential overlap shall be wrapped around the outside of the Saran 540 vapor retarder on 12" centers.

E. Chilled water system pumps shall be insulated with same insulation material and thickness as connected piping. Insulation shall be secured with stainless steel straps. Insulation on pumps shall be formed such that it can be removed for pump servicing.

F. All heating hot water supply and return piping fittings, valves, elbows, etc., shall be insulated with 4 lb. density snap on type glass fiber pipe insulation in molded sections with factory applied all service jacket. Provide high density insulation inserts at all pipe hangers as detailed on the drawings. Seams shall be closely butted together and secured by self-sealing or pasting the all service lap. Fittings insulation shall be milled pre-fabricated of same material and thickness as on adjacent pipe. Fittings shall have factory preformed PVC jacket covers. Insulation thickness shall be as shown in the schedule on the drawings. Piping exposed in occupied spaces or mechanical spaces shall have canvas jacket lagged in place for painting.

G. Air handling unit drain pan condensate piping on interior, pumped condensate piping, make-up water piping, and all refrigerant piping shall be insulated with tubular closed cell elastomeric insulation with all joints butted and cemented tight. Insulation shall have two coats of exterior protective coating on all insulation exposed on exterior. Insulation on make-up water piping and interior condensate piping shall be 1" thick. Insulation on refrigerant piping shall be 1-1/2" thick.

230521 SPECIALTIES

A. Thermometers (9" long) and gauges (4-1/2" dial) shall have metal case with white backgrounds, black numerals and graduations, and red non-mercury, non-alcohol indicating fluid. Ranges shall be selected to indicate operating conditions at mid-scale. Accuracy shall be within 1% of scale range. Pressure gauges shall be compound. Mounting provisions shall provide for insertion of well with separable socket into piping at an angle to permit reading from the floor and shall be of adequate length to project through insulation. Thermometers and gauges shall be Bitmet, Mueller, Taylor, or approved equal. Gauges shall have shut-off cocks.

B. Air vents shall be provided at all points on the piping systems where required to eliminate air from the system. The air vents shall be manual or high capacity automatic type as indicated and manufactured by Bell and Gossett, Hoffman or Armstrong.

C. Strainers shall be screwed (2" and smaller) or flanged (2-1/2" and larger), Y type, 125 pounds, with removable stainless steel screen and shall be provided with close-nipple blowout and ball valve on discharge side. Screen perforations shall be suitable for water flow as appropriate. Screen perforations in strainers at chillers shall be per chiller manufacturer's installation requirements.

D. Pressure reducing valves shall have body and all working parts of brass, built in strainer, and factory set at 45 psig. Valve shall be Bell and Gossett, Taco or Sarco.

E. Floor, wall and ceiling plates or escutcheons of size to fit pipe covering shall be installed where pipes pass thru finished areas and shall be chromium plated spring type as manufactured by Kenney, Connecticut Stamping and Bending Company, Dearborne or approved equal.

F. Pressure relief valve shall be ASME and NB approved with setting and capacity as shown on the drawings or as required. All working parts shall be of non-ferrous metal. The valves shall be Bell and Gossett, Taco, or Sarco.

G. Unions or flanges shall be provided throughout the piping system to facilitate the removal and servicing of all valves, equipment, items, etc.

H. Site flow indicator shall be carbon steel with two tempered glass windows on opposite sides of body rated for 200 P.S.I. Five-bladed propeller shall be "Delrin" material rated for 350°F.

I. Pressure and temperature taps shall be 1/4" MPT fitting to receive either a temperature or pressure probe 1/8" OD. Fitting shall be solid brass with two valve cores of Nordel (Max 275°F) at 500 PSI, fitted with a color-coded cap strap with gasket, and shall be rated at 1000 PSIG at 140°F. Temperature and pressure probe readout kit shall be delivered to Owner for maintenance use.

230522 FOUNDATIONS

A. All concrete and reinforcing steel for foundation slabs under equipment shall be provided by the Heating and Air Conditioning Contractor. Foundations shall extend beyond all equipment by 4" in all directions and shall be made from 3,500 PSI concrete reinforced with 10/10 x 6/6 wire mesh. Foundation surfaces shall be troweled smooth and edges shall be tooled. Equipment pads shall be painted OSHA approved yellow.

230523 VIBRATION ISOLATION

A. Pad type isolators shall be 3/4" thick bridge bearing quality neoprene ribbed or waffled on both sides. Pads shall be selected for a maximum durometer of 50 and designed for 15% deflection. Where required, steel load-spreading plates shall be incorporated between the equipment and the neoprene pad.

B. Flexible duct connections, both at inlet and discharge of units, shall be made of 30 oz. workinglass fiber coated with neoprene, sewn together at edges and joints. These flexible connections shall withstand the operating air-pressure, shall not permit air leakage, and shall not transmit vibration.

230524 OPENINGS

A. The Heating and Air Conditioning Contractor shall furnish all blockouts, sleeves, and openings required for his work. Pipe sleeves, where firestop penetration system allows, shall be standard weight black steel pipe and shall be provided where pipes pass through walls and floor. Sleeves through walls shall butt flush with the wall finish and shall be of sufficient size to permit passage of pipe covering through the area where pipe is installed. Sleeves through floors shall extend 3/4" above the finished floor and sealed watertight. Any penetrations of ducts through floor shall be curbed 3" high x 6" wide with concrete. Specifically inform the General Contractor as to the correct size and location of openings and sleeves to insure that they shall be cast in their proper location. Sleeves and duct opening frames shall be furnished and installed by the Heating and Air Conditioning Contractor. Failure to indicate such openings in time to avoid delaying the General Contractor shall result in the Heating and Air Conditioning Contractor providing all cutting and repairing at his own expense. Repairing shall include sealing tight around pipe sleeves and duct frames in a neat and professional manner and in accordance with the "Cutting and Patching" section of this specification.

B. All penetrations in rated floors, firewalls and any other rated separations shall be protected using a through-penetration firestopping method with an "F" rating equivalent to the rating of the membrane being penetrated for particular piping materials used and membrane construction type. Floor penetrations shall additionally have a "T" rating equivalent to the rating of the floor being penetrated. Through-penetration firestop systems shall be installed and tested in accordance with ASTM E814 or UL 1479.

C. Through-penetration firestop details indicated on the drawings are suggestive only. Heating and Air Conditioning Contractor shall submit for approval specific through-penetration firestop system details to be used.

230525 COLOR CODING/PAINTING

A. Insulation on piping and equipment in mechanical equipment rooms shall be finished with color coded canvas jacket. Non-insulated piping in mechanical equipment rooms shall be painted with two coats of gloss enamel. Painting shall be primed and in accordance with the painting section of these specifications. Color coding shall be as follows:

1. Chilled Water Supply and Return Piping – Light Blue.
2. Hot Water Supply and Return Piping – Light Red.
3. All Ferrous Valves, Hangers, and Supports - Black.
4. All exposed mechanical equipment in finished areas including ductwork, piping hangers, etc., shall be painted the same color as the adjacent ceiling and walls by the General Contractor. Heating and Air Conditioning Contractor shall treat all items as necessary to receive paint.

230526 PIPE MARKERS

A. Markers shall have wording, wording colors, and wording background in accordance with ANSI A13.1. Markers shall have letters approximately 1" high on appropriate background, flow arrows, and shall be located on the pipe at intervals not exceeding 10'-0" where in mechanical spaces and 25'-0" intervals elsewhere. Markers shall be plastic with markers on piping completely encircling the pipe with overlap and permanent tension in the marker to grip the pipe firmly with the need of adhesives. Provide markers on all new piping in the building. Wording of markers shall be as follows:

1. Hot Water Supply - Hot Water Return.

2. Chilled Water Supply – Chilled Water Return.

230527 NAMEPLATES

A. All new air handling type units, heaters, power ventilators, and pumps shall be furnished with engraved plastic laminated labels permanently attached to the equipment. Lettering shall be 1/2" tall. Label shall include equipment number, area served, final acceptance date, number and size of filters, number and size of belts, and capacities. Final acceptance date shall be on a separate label so as to allow equipment nameplates to be installed prior to final acceptance.

230528 CUTTING AND PATCHING

A. The Heating and Air Conditioning Contractor shall do all cutting and patching necessary to install all equipment as required under his contract in accordance with the General Conditions of these specifications and shall re-establish all finishes where cutting and patching occur to their original condition. All cutting of the structure, where unavoidable, must be approved by the Engineer and be done by the General Contractor, but shall be paid for by the Heating and Air Conditioning Contractor.

230529 PIPING PRESSURE TESTING

A. The Heating and Air Conditioning Contractor shall make the following tests before the systems are insulated or covered by construction. The systems shall have no decrease in pressure during the test periods. All system components shall be protected from test pressures that exceed manufacturer's design limits.

B. Notify Architect, Engineer, and Commissioning Authority 48 hours in advance of all tests.

C. Heating and Air Conditioning Contractor shall provide written report of each test.

D. New chilled water and hot water piping shall be tested by applying a hydrostatic pressure of 1.5 times system's working pressure or 150-PSIG, whichever is greater but not exceeding the maximum pressure rating for any component in the system under test, for a period of four (4) hours. Existing piping, chillers, and boilers shall be isolated during testing.

E. Condensate and make-up water piping shall be tested by applying a hydrostatic pressure of 100-psig for a period of two hours.

F. No caulking of joints shall be permitted. Any joint found to leak under this test shall be broken, remade, and a new test applied. Welded joint pinhole leaks shall be repaired by welding; however, welds that show numerous pinholes shall be replaced.

230530 TESTING AND BALANCING

A. Testing and balancing of the new or renovated heating, ventilating, and air conditioning systems shall be performed by an independent AABC certified Test and Balance Company as a subcontractor to the Heating and Air Conditioning Contractor. All instruments used shall be accurately calibrated and in good working order. The tests shall be in strict accordance to the Standards of AABC. Test and Balance Contractor shall submit TAB plan to the Engineer and Commissioning Authority for their review and approval prior to starting any TAB work.

B. Air balance and testing shall not begin until the systems have been installed in full working order and shown to be operating satisfactory on both heating and cooling. The Contractor shall place all heating, ventilating, and air conditioning systems into full operation and shall continue operation of the system

until balancing is completed. All operational cost shall be borne by the Heating and Air Conditioning Contractor. The Architect and Engineer shall be given three weeks advance notice of when tests are to be made.

C. Upon completion of the heating, ventilating, and air conditioning systems, the Test and Balance Contractor shall compile the test data and submit four copies of the certified and completed test data to the Engineer for evaluation and approval. At final inspection and prior to final commissioning verification, Heating and Air Conditioning Contractor shall have a copy of test and balance report and all necessary personnel and equipment to facilitate spot-checking of test and balance data by the Engineer or his representative. Final payment to the Contractor shall be withheld until the complete test and balance data has been approved.

D. Testing Procedure (AIR):

1. Test and adjust air handling unit fan's RPM and CFM to design requirements. Record all data.
2. Test and record motor full load amperes on all motors.
3. Adjust all main supply, exhaust, return, relief, and outside air ducts to proper design CFM when air handling systems are in normal operating mode, DCV mode, and in outside air economizer mode. Record exhaust, relief, and outside air data.
4. Test and adjust each diffuser, grille, and register for supply, exhaust, or return systems to within 10% of design requirements. Record all data.
5. All adjustments to air diffusing devices where possible shall be made in trunk or run out dampers, not at diffuser volume control.
6. Exhaust fans shall be tested and balanced for the requirement as shown on the plans. Record all data.
7. The Heating and Air Conditioning Contractor shall make any changes in the pulleys, belts, filters, dampers, or valves necessary or as recommended by the Engineer for correct balance at no additional cost to the Owner.

E. Testing Procedure (Water):

1. All air systems shall be balanced prior to water balance.
2. Open all valves to full open position.
3. Clean all strainers.
4. Set mixing valves to full coil flow.
5. Check expansion/compression tanks to determine that they are not air bound.
6. Check all air vents at high points of water systems to insure their installation and operation.
7. Set water system pumps to proper gallons per minute delivery. Record all data for each pump.
8. Check and record motor full load amperes.
9. Check and record coil inlet water temperature and air temperature drops or rises across coils for full cooling and full heating.
10. Test and adjust each fluid balancing item to within 5% of design requirements. Record all data.

230531 INSTRUCTIONS/TRAINING

A. The Heating and Air Conditioning Contractor shall give an instruction and training period in the operation of the new apparatus to the persons who will be in charge of the system. See Section 017900 for listing and training requirements.

230532 MAINTENANCE DATA

A. For all new items requiring maintenance, the Heating and Air Conditioning Contractor shall furnish prior to Final Acceptance and deliver to the Owner's representative on the job multiple copies of complete data as prepared by the manufacturer covering the details of operation and maintenance and complete parts list for all equipment specified. Each copy of the maintenance data shall be assembled into a 3-ring

hardback binder with indexing and label on cover and spine. See Section 017823 for complete requirements. Data shall have equipment model numbers, etc. indicated and referenced with the same mark as shown on equipment on the drawings. Provide filter schedules for all equipment requiring filters. Manuals shall have index with page numbers, Contractor's certificate of Final Acceptance, copy of all warranties, list of all subcontractors and suppliers with names, addresses, and phone numbers, certified test and balance report, complete start-up, operation, and shut-down procedures for each system, lubrication schedules and types of lubricates, equipment summary showing all capacities and ratings, and all submittal data and shop drawings.

230533 RECORD DRAWINGS

A. In accordance with Section 017839 Project Record documents, the Heating and Air Conditioning Contractor shall maintain "during the course of the work" a set of specifications and drawings marked up to show the new and renovated work as installed. Upon completion of the work, return this set of drawings to the Architect.

230534 GUARANTEE

A. The Heating and Air Conditioning Contractor shall guarantee the entire heating and air conditioning system subject to the General Conditions of these specifications.

END OF SECTION 230500

SECTION 230900 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

A. Furnish and install an electric control system to fulfill the intent of the drawings and specifications. The systems shall include all necessary labor, electrical wiring, BAS communication buss wiring, DDC controllers, building controllers, sensors, devices, and materials for a complete installed DDC BAS control system.

B. New controls shall be connected to and be a fully compatible and functional extension of the existing Honeywell Direct Digital Control (DDC) Energy Management and Building Automation System (BAS).

C. System architecture shall be LON protocol controllers and devices communicating to existing Honeywell WEB-600 JACE's. Protocol shall be concurrent throughout the project.

D. System architecture shall be fully modular permitting expansion of application software, system peripherals, and field hardware.

E. System architecture shall provide secure Web access using MS Internet Explorer or as necessary from any computer connected to the building's network.

F. BAS graphics shall match existing graphics. Graphics shall reside on the building controller. Graphics shall be appropriate for the systems installed and as customary for BAS systems. Graphics shall be Web based viewable and manipulatable through graphical user interface through network connection via the appropriate level of password access control.

G. If any system or product specific software or licenses are required to access the controllers/programming and requires an annual fee for the software/licenses, the controls contractor shall supply five (5) licenses to the Owner. These five (5) licenses shall be upgraded every year by the vendor as not to expire, all licenses shall be upgraded when new versions or firmware are released. The vendor shall maintain all product and software support for each copy. This term will last for as long as the software is supported by the manufacturer.

H. The control system shall be erected, assembled, and installed by factory-trained mechanics regularly employed by the control provider or manufacturer's authorized distributor as a subcontractor to the Heating and Air Conditioning Contractor. All equipment, unless specified to the contrary, shall be fully proportional and shall be the product of the control manufacturer.

I. The control diagrams indicated on the drawings or specified herein show the intended sequences of operation of the various control systems and shall be followed as closely as practicable. All required devices and control schemes may not be shown on the drawings. It is the Contractor's responsibility to provide all devices and control schemes whether shown or not.

J. Additional General Requirements for Controls:

1. All material and equipment used shall be standard components and software, regularly manufactured and available, and not custom designed especially for this project.

2. All wiring, conduit, and panels for all temperature controls.
3. Power required for controls shall be provided by the Controls Contractor from points coordinated with the Electrical Contractor.
4. Perform all wiring in accordance with all local and national codes and Division 26 of these specifications.
5. Surge transient protection shall be incorporated in the design of the system to protect electrical components in all system components as described below under "General Product Description."
6. System modifications necessary to fine-tune sequences during commissioning of systems at no additional cost to the Owner.
7. Mount control devices inside of a UL-listed steel enclosure panel, with hinged locking cover and key locking latch.

K. Wiring and Controls:

1. Control Contractor shall be responsible for the installation and wiring of temperature controls, control interlock wiring, electrical controls and devices in the temperature control system.

1.3 QUALITY ASSURANCE AND STANDARDS

A. Materials and equipment shall be the cataloged products of manufacturers regularly engaged in production and installation of integrated control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

B. All products used in this project installation shall be new and currently being manufactured. This installation shall not be used as a test site for any new products. Spare parts shall be available for at least five years after completion of this contract.

C. Install system using competent workmen who are fully trained in the installation of integrated control systems.

D. Single source responsibility of Contractor shall be the complete installation and proper operation of the control system and shall include debugging and proper calibration of each component in the entire system.

E. Contractor shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

F. The Contractor and manufacturer representative shall support the installed system for a minimum of 1 year. The support shall provide full material warranty of controllers and 8 hours of on-site training.

G. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Section 15, governing Radio Frequency Electromagnetic Interference and be so labeled.

H. Design and build all system components to be fault-tolerant.

1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3-Hertz variation in line frequency.
2. Static, transient and short-circuit protection on all inputs and outputs.
3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.
4. Network-connected devices to be A.C. coupled or equivalent or that any single device failure will not disrupt or halt network communication.
5. All real time clocks and data file RAM to be battery-backed for a minimum 72 hours and include local and system low battery indication.
6. All programs shall retain their memory for a minimum of 7 days upon loss of power.

I. Comply with NFPA 90A, Standard for Installation of Air Conditioning and Ventilating Systems.

J. Provide wiring in accordance with NEC requirements and Division 26 of these Specifications.

1.4 SUBMITTALS

A. Product Data: Submit copies of manufacturer's technical product data for each control device furnished. Indicate dimensions, capacities, performance, electrical characteristics, material finishes; also include installation and start-up instructions.

B. Shop Drawings: Submit copies of shop drawings for each control system, containing at least the following information:

1. Schematic flow diagram of system showing fans, pumps, coils, dampers, valves, control devices and all interconnections between devices.
2. Indicate all required electrical wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
3. Written description of sequence of operation.

C. Number of copies of Product Data and Shop Drawings shall be per Division 1 of these Specifications.

1.5 DELIVERY, STORAGE AND HANDLING

A. Provide equipment and control devices in factory shipping carton. Maintain in cartons while shipping, storing and handling as required to prevent equipment damage and to keep dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Building controls, controllers, and communications between devices shall be provided as necessary to achieve specified sequences of operation.

B. All sensors, actuators, etc. shall be electronic.

C. Room mounted temperature sensors shall have digital display of room temperature and setpoint, setpoint adjustment, integrated occupancy sensor, and pushbutton override with status indicator, except in public areas such as Queuing and Ticketing areas where sensors will be blank covers.

D. Duct-Mounted Temperature Sensors: 20,000-ohm thermistor temperature sensors with an accuracy of ± 0.2ºC. Duct-mounted sensors shall have an insertion measuring probe of a length appropriate for the duct size, with a temperature range of -40 to 160 degrees F. The sensor shall include a utility box and a gasket to prevent air leakage and vibration noise. For all mixed air and preheat air applications, duct-mounted sensors shall be bendable averaging duct sensors with a minimum 8 - foot long sensor element. These devices shall have accuracy of 0.5 degrees, F., over the entire range.

E. Humidity sensors shall be thin-film capacitive type sensor with on-board nonvolatile memory, accuracy to plus or minus two percent (2%) at 0 to 90% RH, 12 - 30 VDC input voltage, analog output (0 - 10 VDC or 4 - 20mA output). Operating range shall be 0 to 100% RH and 32 to 140 degree F. Sensors shall be selected for wall, duct or outdoor type installation as indicated on the drawings. Space mounted sensors shall have blank display. Duct mounted sensors shall have LCD display.

F. Motorized control dampers that will not be integral to the equipment shall be furnished by the Control System Contractor. See Section 230500 for specification of motorized control dampers.

G. Control damper actuators shall be furnished by the Control System Contractor. Two-position or proportional electric actuators shall be direct-mount type sized to provide a minimum of 5 in-lb torque per square foot of damper area. Damper actuators shall be spring return type. Operators shall be heavy-duty electronic type for positioning automatic dampers in response to a control signal. Motor shall be of sufficient size to operate damper positively and smoothly to obtain correct sequence as indicated. All applications requiring proportional operation shall utilize truly proportional electric actuators.

H. Control valves and actuators shall be furnished by the Control System Contractor. The Heating and Air Conditioning Contractor shall install all valves. Characterized control valves shall be used for hydronic heating or cooling applications and small to medium AHU water-coil applications to 100 GPM. Actuators are non-spring return for terminal unit coil control unless otherwise noted. If the coil is exposed to the outside air stream, see plans for spring return requirement.

1. Override handle and gearbox release shall be provided for all non-spring return valve actuators.
2. Valve leakage is 0% (zero percent), close-off is 200psi, maximum differential is 30psi; rangeability is 500:1.
3. Valves 0.5–2 inches shall be nickel-plated forged brass body, NPT screw type connections.
4. Valves 0.5–1.25 inches shall be rated for ANSI Class 600 working pressure.
5. Valves 1.5 and 2 inches shall be rated for ANSI Class 400 working pressure.
6. The operating temperature range shall be 0–250 degrees F.
7. Stainless steel ball and stem shall be furnished on all modulating valves.
8. Seats shall be fiberglass reinforced Teflon.
9. Two-way and three-way valves shall have an equal percentage control port. Full stem rotation is required for maximum flow to insure stable BTU control of the coil.
10. Three-way valve shall be applicable for both mixing and diverting.
11. The characterizing disc is made of TEFZEL and shall be keyed and held secure by a retaining ring.
12. The valves shall have a blow-out proof stem design.
13. The stem packing shall consist of two (2) lubricated O-rings designed for on-off or modulating service and require no maintenance.
14. The valves shall have an ISO type, 4-bolt flange for mounting actuator in any orientation parallel or perpendicular to the pipe. A non-metallic thermal isolation adapter shall separate valve flange from actuator.
15. One (1) fastening screw shall secure the direct coupling of the thermal isolation adapter between the actuator and the valve. This will prevent all lateral or rotational forces from affecting the stem and its packing O-rings.
16. See notes on schedules on the drawings for design basis maximum pressure drop allowed for coil **plus** control valve.

I. Carbon monoxide (CO) Sensing System: Shall consist of control panel with remote CO sensors. CO sensors shall be mounted 3-5 feet from floor. Quantity of each type sensor shall be a function of sensor coverage capability. Sensors shall have electrochemical cell sensors and LED status indicators. Control panel shall have LED status indicators, visual alarm, microprocessor based control, programmable time delays, and LON digital signal output. Setpoints shall be:

Toxic Gas	First Alarm Setpoint (TLV-TWA)	Second Alarm Setpoint (TLV-STEL)	Area of Coverage
Carbon Monoxide (CO)	35 ppm	100 ppm	5000 SF

J. Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point. Manufacturer: Veris, or approved equivalent.

K. Relays: Start/stop relay model shall provide either momentary or maintained switching action as appropriate for the motor being started. All relays shall be plugged in, interchangeable, mounted on a subbase and wired to numbered terminals strips. Relays installed in panels shall all be DPDT with

indicating lamp. Relays installed outside of controlled devices shall be enclosed in a NEMA enclosure suitable for the location. Relays shall be labeled with UR symbol. RIB-style relays are acceptable for remote enable/disable.

L. Control Power Transformers: Provide step-down transformers for all DDC controllers and devices as required. Transformers shall be sized for the load, but shall be sized for 50 watts, minimum. Transformers shall be UL listed Class 2 type, for 120VAC/24VAC operation.

M. Line Voltage Protection: All control system panels that are powered by 120 VAC circuits shall be provided with surge protection. This protection is in addition to any internal protection provided by the manufacturer. The protection shall meet UL, ULC 1449, IEEE C62.41B. A grounding conductor, (minimum 12 AWG), shall be brought to each control panel.

N. Enclosures: May be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment. Enclosures shall have hinged, locking doors.

1. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 0.125 inches thick and appropriately sized to make label easy to read.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install systems and materials in accordance with manufacturer’s instructions in a neat workmanlike manner.

B. Coordinate with other trades on the project as the work progresses so that each will be aware of the extent of all work. Carefully plan all work and check for interferences before installation. No extras will be allowed for changes caused by failure to check for interferences.

C. Provide structural supports as required for panels and control devices.

D. Supervise installation of all control dampers.

E. Install metering devices away from bends and elbows with minimum upstream and downstream straight distances per manufacturer’s recommendations and as shown on Drawings.

3.2 CONTROL WIRING

A. Install color-coded control wiring without splices between terminal points in accordance with National Electrical Code.

B. Control wiring shall be yellow jacketed No. 22 TSP for inputs and outputs.

C. Communication buss wiring shall be purple jacketed No. 22 TSP.

D. All wiring and cable not in conduit shall be plenum rated.

E. Wiring above lay-in ceilings may be installed as properly supported cable.

F. Wiring above hard ceilings, in walls, in shafts, or where exposed including in mechanical rooms shall be in 3/4” minimum EMT conduit with steel-plated hexagonal compression connectors. Flexible metallic

conduit shall be 1/2" minimum in size and not exceed 3'-0" in length. EMT and flexible metallic conduit shall be blue in color.

G. All wiring in floor slabs or on exterior shall run in rigid conduit.

3.3 TESTING

A. When installation of the control system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line.

B. Provide a cross check of each control point within the control system by making a comparison between the control command and the field-controlled device.

C. Replace any work found defective. After replacement, repeat test.

3.4 START-UP AND DEMONSTRATION

A. After completion and testing of the installation, regulate, adjust and service as necessary all control devices in the systems, placing each item in complete and proper operation.

B. Demonstrate all systems to Owner, Architect and Engineer, and that all are operable from local controls in the specified failure mode upon electronic control system failure or loss of power.

C. Complete all commissioning requirements as necessary to this scope of work.

3.5 INSTRUCTION

A. Provide the services of manufacturer's technical personnel for 8 hours of instruction to Owner's personnel in the operation, maintenance and programming of the control system. Orient the training specifically to the system installed rather than a general training course.

B. Provide training manuals, equipment and material required for classroom training.

C. Training to include the following items:

1. Operation of equipment
2. Programming
3. Diagnostics
4. Failure recovery procedures
5. Alarm formats (where applicable)
6. Maintenance and calibration
7. Trouble shooting, diagnostics, and repair instructions

PART 4 - POINTS LISTS AND SEQUENCES OF OPERATION

4.1 SUMMARY

A. The drawings indicate the individual types of systems and the points required in each system.

B. System sequences of operation shall be as indicated on the drawings and as specified herein.

END OF SECTION 230900

SECTION 260000 - ELECTRICAL, BASICS

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 GENERAL

A. Applicable requirements of the Instructions to Bidders and General Conditions of the Contract shall be a part of the Electrical Specifications. The electrical contractor shall examine the general and special conditions before submitting a proposal.

B. The electrical work shall be performed by a licensed electrical contractor.

C. The electrical contractor shall assume total responsibility for any portion of the work provided by his subcontractors.

1.3 CODES AND STANDARDS

A. Building Codes:

1. National Fire Protection Association No. 70, National Electrical Code
2. North Carolina State Building Code, Latest Edition and Revisions (NCSBC)
3. National Electrical Safety Code (NESC)
4. National Bureau of Standards (NBS)
5. Local Codes where applicable

B. Industry Standards:

1. Underwriter's Laboratories, Inc. Standards and approved listings (UL)
2. Electrical Testing Laboratories Standards (ETL)
3. National Electrical Manufacturers Association Standards (NEMA)
4. Insulated Power Cable Engineers Association Standards (IPCEA)
5. American National Standards Institute (ANSI)
6. American Society for Testing Materials Standards (ASTM)
7. Canadian Standards Association (CSA)

1.4 SCOPE OF WORK

A. It is the intent and meaning of the drawings and specifications to call for finished work that has been tested and is ready for operation. The electrical contractor shall take this into consideration and include in his proposal allowance for contingencies that will allow him to provide minor pieces of materials and labor not specifically indicated but required for the job to operate properly. This paragraph is intended to insure a complete job will be provided without requests for minor extras.

1.5 RECORD DRAWINGS

A. A set of drawings covering the electrical contract will be provided to the electrical contractor to mark all changes, modifications, or revisions effected during construction. These field mark-up drawings are to be turned over to the electrical designer.

B. The electrical contractor shall provide photographs of switchboards and panelboards. Photographs shall clearly show equipment designations, manufacturer nameplates, breaker positions, breaker ratings, and directory descriptions.

1.6 APPROVAL OF MATERIALS

A. Construction Phase: The CONTRACTOR shall submit his proposal on the specified materials and equipment, or their equivalent, provided the words "or equal" or "or approved equal" follow the named manufacturers. If the above phrases do not appear, the specified manufacturers shall be furnished without substitution. Equivalent shall be interpreted to mean an item of material or equipment, similar to that named and which is suitable for the same use and capable of performing the same functions as that named, the ARCHITECT and/or ENGINEER (A/E) being the judge of equality.

B. Where no specific material or equipment type is mentioned, any first-class product of a reputable manufacturer may be used provided it conforms to the requirements of the specifications. These materials shall be third party listed or labeled in accordance with the General Statutes of the State (example: UL, ETL, CSA, etc.).

1.7 SHOP DRAWINGS AND SUBMITTAL DATA PROCEDURES

A. Unless directed otherwise in the Architectural Specifications, Civil Specifications, or General Provisions and/or Conditions of the Contract, the CONTRACTOR shall submit PDF files of shop drawings, certified prints, literature, and cuts to the A/E for all major items of equipment and materials for review and approval. It is preferred that all electrical submittals for the project shall be submitted at one and the same time.

B. Product data cut sheets with multiple components, part numbers, etc. shall be clearly marked to identify what is proposed for this project.

C. The CONTRACTOR shall analyze all shop drawings and submittal data and certify that they meet requirements of Contract Drawings and Specifications, prior to delivery to the A/E. CONTRACTOR Certification shall be in the form of suitable approval stamp placed on each shop drawing submitted for approval.

D. If the A/E deems submittal data is either incomplete or incorrect, a resubmittal submittal will be required.

E. At least one set of all “approved” shop drawings, certified prints, etc., shall be maintained at the job site and available to representative of the A/E.

F. Approval by the A/E of shop drawings for any materials, apparatus, devices, and layouts shall not relieve the CONTRACTOR from the responsibility of furnishing same of proper dimensions, size, quantity, quality and all performance characteristics to efficiently perform the requirements and intent of the contract documents. Such approval shall not relieve the CONTRACTOR from responsibility for errors of any sort on the shop drawings. If the shop drawings deviate from the Contract Documents, the CONTRACTOR shall advise the A/E of the deviations in writing, accompanying the shop drawings, including the reason for the deviations.

G. Physical sizes of equipment used in the design layout are those of reputable equipment manufacturers. The CONTRACTOR is responsible for providing equipment that will fit the space available. If the CONTRACTOR elects to use equipment that results in conflicts with space clearance or codes, it shall be the responsibility of the CONTRACTOR to correct at his expense. The CONTRACTOR shall assume responsibility for providing code clearances. Where equipment is designated for existing space, the CONTRACTOR shall make necessary field measurements to ascertain space requirements, including

those for connections; and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the intent and meaning of the drawings and specifications.

H. Catalog Data for OWNER:

1. The CONTRACTOR shall provide compilations of catalog data, bound in suitable loose-leaf binders, for each manufactured item of equipment used in the electrical work. These shall be presented to the A/E for transmittal to the OWNER before the final inspection is made. Data shall include printed installation, operation, and maintenance instructions for each item, indexed by product with heavy sheet dividers and tabs. All warranties shall be included with each item. Each manufacturer's name, address, and telephone number shall be clearly indicated. Generally, shop drawings and submittal data alone are not adequate for catalog data.

I. Record Documents for OWNER:

1. Conductor and cable megger test results.
2. Transformer tap settings and output voltages.
3. Circuit breaker trip settings.
4. Communications backbone cable:
    a. Test results.
5. Cable schedules.
6. Communications horizontal cable:
    a. Test results.
    b. Cable schedule.
7. Fire alarm system:
    a. NFPA 72 Fire Alarm System Record of Completion.
    b. System Status and Programming Report.
    c. System operational matrix.
    d. Digital copy of system software on USB flash drive.

1.8 DRAWINGS AND SPECIFICATIONS

A. The Electrical drawings and specifications are complementary each to the other, and what may be called for by one shall be as binding as if called for by both. The drawings are diagrammatic and indicate generally the location of outlets, devices, equipment wiring, etc and show the general arrangement of raceways, fixtures, and equipment. Drawings shall be followed as closely as actual building construction and the work of other trades will permit; however, all work shall suit the finished surroundings and/or trim.

B. It shall be understood that where the words "furnish," "provide," and/or "install" are used, it is intended that this CONTRACTOR shall purchase and install completely all material necessary and required for this particular item, system, equipment, etc.

C. Any omission from either the drawings or the specifications are unintentional, and it shall be the responsibility of the CONTRACTOR to call to the attention of the A/E any pertinent omissions before submitting a proposal. Complete and working systems are required, whether every small item of material is shown and specified or not.

D. The electrical work shall conform to the requirements shown on all of the drawings. General and Structural drawings shall take precedence over Electrical Drawings. Because of small scale of the electrical drawings, it is not practical to indicate offsets, fittings and accessories that may be required. The CONTRACTOR shall investigate the structural and finish conditions affecting the work and shall

arrange his work accordingly, providing such fittings and accessories as may be required to meet such conditions, without additional cost to the OWNER and as directed by the A/E.

E. Load circuits shall be installed as indicated on the drawings. Circuit number revisions will not be accepted unless approved in writing by the Engineer.

1.9 COORDINATION OF WORK

A. It is understood and agreed that by submitting a bid, the CONTRACTOR has, by careful examination, satisfied himself as to the nature and location of the work, the conformation of the ground, the character, quality and quantity of the materials to be encountered, the general and local conditions and all other matters which can and may affect the work under this contract. The CONTRACTOR shall be held responsible for visiting the site and thoroughly familiarizing himself with the existing conditions and also any contractual requirements as may be set forth in the other divisions of these specifications. No extras will be considered because of additional work necessitated by obvious job conditions that are not indicated on the drawings.

B. The CONTRACTOR shall compare the electrical drawings and specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the A/E and obtain from him written instructions for changes necessary in the electrical work. The electrical work shall be installed in cooperation with other trades installing interrelated work. Before installation, the CONTRACTOR shall make proper provisions to avoid interferences in a manner approved by the A/E. All changes required in the work of the CONTRACTOR caused by his neglect to do so shall be made by him at his expense.

C. Location of electrical raceways, switches, panels, equipment, fixtures, etc., shall be adjusted to accommodate the work to interferences anticipated and encountered. The CONTRACTOR shall determine the exact route and location of each electrical raceway prior to make up and assembly.

D. Right-of-Way: Lines which pitch shall have the right-of-way over those which do not pitch. For example, steam, condensate and plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.

E. Offsets and changes in direction of electrical raceways shall be made as required to maintain proper headroom and to clear pitched lines whether or not indicated on the drawings. The CONTRACTOR shall furnish and install elbows, pull boxes, etc., as required to affect these offsets, transitions, and changes in directions. Conflicts between electrical raceways, fixtures, etc., and ductwork which cannot be resolved otherwise, will be resolved by the A/E.

F. The CONTRACTOR shall install all electrical work to permit removal (without damage to other parts) of any equipment requiring periodic replacement or maintenance. The CONTRACTOR shall arrange electrical raceways and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging and overhead doors and of access panels.

G. Work at Existing Facilities:

1. Where work may be required to be performed at existing and/or occupied facilities, such work shall be scheduled and arranged to be done at the convenience of the OWNER so as not to interfere with, disrupt, or disturb normal operations at the facilities. The CONTRACTOR shall obtain written approval from the OWNER before proceeding with work at existing facilities and shall work at existing facilities on schedule as agreed upon with the OWNER. This is not to be necessarily construed to mean that the CONTRACTOR is expected to perform work at existing facilities on holidays, weekends, etc., but that the Contractor must schedule work with the OWNER for the OWNER’s beneficial and normal usage of the facilities, and that the CONTRACTOR will be required to maintain the schedule as approved by the OWNER.

2. The CONTRACTOR shall, at all times, provide safety barriers, protective devices, screening, dust barriers, etc., as required to maintain the safety and comfort of the building's personnel and/or occupants in or near his work area.
3. The CONTRACTOR shall be responsible for cleanup in connection with his work at existing facilities. At the end of each working day, all debris, boxes, waste, etc. shall be removed from the facilities and properly disposed of. Equipment, materials, etc. may be left inside the facilities, but such must be properly stored, stacked, and located as approved by the OWNER.
4. The CONTRACTOR shall do all cutting, patching, finishing, repairing, painting, etc., necessary for electrical work to be installed at existing facilities. All finishes shall be left to equal finish and condition prior to cutting. No cutting of structural members will be allowed. All cutting of walls, floors, roofs, etc. shall be repaired and/or replaced to equal finish prior to cutting. The CONTRACTOR shall route conduits and locate equipment as approved by the OWNER and A/E. Routing and locations shall be firmly established and approved before proceeding with any phase of the work.
5. The CONTRACTOR shall be responsible for any and all damage to the existing facilities, grounds, walkways, paving, etc. caused by the work, the CONTRACTOR and/or his personnel, and/or his equipment in the accomplishment of this work. Such damages shall be repaired and/or replaced by the CONTRACTOR at no additional cost to the OWNER, to equal finish prior to damage. The A/E shall be the judge as to equal finishes, etc.
6. Certain power requirements must be met without interruption during certain times on the existing electrical system. It is anticipated that partial power outages will be necessary to accomplish the work covered by these drawings and specifications. The CONTRACTOR shall determine in advance the dates, times and duration of these outages and shall obtain permission from the OWNER to shut down the electric power. Unauthorized power outages will not be tolerated.

H. Electrical Work Coordinated with Other Disciplines:

1. Heating, Ventilating and Air Conditioning Equipment:

   a. The electrical contractor shall provide a source of power for all mechanical equipment. "Source" shall include conductors, raceways, circuit breakers, junction boxes, panelboards and/or wiring troughs as required by conditions and codes and/or as shown on the contract drawings.
   b. In general, individual disconnecting means and circuitry for each mechanical equipment unit will be furnished and installed by the electrical contractor. Line side and load side connections at the disconnect shall be made by the electrical contractor. Load side wiring from the disconnect shall be installed by the EC, and equipment connections shall be made by the Mechanical subContractor.

2. Plumbing Equipment

   a. Electric Water Coolers: As indicated on the drawings, the electrical contractor. shall provide either a grounding type 120V, GFCI receptacle for power supply at each electric water cooler, or the branch breaker supplying a grounding type 120V receptacle shall be GFCI type. The electrical contractor shall consult the Plumbing Contractor to determine the exact outlet location required before roughing in. All outlets and cords shall be concealed within the cabinet.
   b. Water Heaters: The electrical contractor shall provide a disconnect adjacent to the water heater as a source of power. Circuitry from the disconnect to the water heater shall be provided by the electrical contractor. Final connections shall be provided by the contractor providing the equipment.
   c. Hot Water Circulating Pump: See drawing detail. The plumbing contractor will provide an "Aquastat". The remainder of devices and equipment shall be provided by the electrical contractor.

I. Equipment and Materials (General):

1. Materials shall be new and shall bear the manufacturer's name, trade name, and listing label in every case where a standard has been established for the particular material. The equipment to be furnished under this specification shall be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment and shall be the manufacturer's latest approved design.
2. Delivery and Storage:
    a. Store products to allow for inspection and measurement of quantity or counting of units.
    b. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
        1) Electrical equipment shall be delivered to the site and stored in original containers. Store inside dry, heated spaces, but readily accessible for inspection by the A/E until installed.
        2) Rusty and/or corroded materials and equipment will be replaced at the direction of the A/E.
    c. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
    d. Protect stored products from damage.
3. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance.
4. At the completion of the work; fixtures, equipment, and materials shall be cleaned and polished thoroughly and turned over to the OWNER in a condition satisfactory to the A/E. Damage or defects, developing before acceptance of the work shall be corrected at the CONTRACTOR's expense.
5. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The CONTRACTOR shall promptly notify the A/E, in writing, of any conflicts between any requirements of the Contract Documents and the manufacturer's directions and shall obtain the A/E's written instructions before proceeding with the work. Should the CONTRACTOR perform any work that does not comply with the manufacturer's instructions, recommendations, or requirements; it shall be corrected at the direction of the A/E at no additional cost to the Owner.

J. Sleeves, Inserts, Openings, Etc.:

1. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work shall be furnished, located, and installed by the electrical contractor. Where working under a subcontract for a General Contractor, the electrical contractor shall give sufficient information (marked and located) to the General Contractor in time for proper placement in the construction schedule. Should the electrical contractor delay or fail to provide sufficient information in time, the electrical contractor shall cut and patch construction as necessary and required to install electrical work, with finishes completed to the satisfaction of the Owner, and A/E.

K. Cutting and Patching:

1. The electrical contractor shall do all rough cutting and patching as required for the proper installation of work under this contract. Cutting shall be kept to a minimum, and finishes shall be restored to the satisfaction of the Owner, and A/E.

L. Locations and Measurements:

1. Outlets, equipment, and appliances are shown and located on the drawings as accurately as possible. All measurements shall be verified on the project and coordinated with the drawings of other disciplines. In all cases, the work shall suit the surrounding trim and/or decoration and construction. The locations of outlets for special appliances shall be installed so that when extended, they are flush with the finished wall, floor, or ceiling and permit the proper installation of fixtures, devices, equipment, appliances, etc. Heights of all outlets shown on the drawings are

approximate only. Slight relocations of outlets, devices, and equipment shall be made by the electrical contractor as required or as directed by the A/E at no additional cost to the OWNER.

M. Workmanship:

1. Work shall be executed as required by the specifications and the accompanying drawings and shall be done in a workmanlike manner by skilled mechanics, and shall present a neat, trim, and mechanical appearance when completed. All work shall be performed as required by the progress of the job.

N. Final Inspections and Equipment Demonstrations:

1. The CONTRACTOR shall acquire permits for construction & coordinate all required inspections with the office of the local electrical inspector and/or local authority having jurisdiction, if required. The CONTRACTOR shall provide the Owner two (2) copies of Electrical Inspectors' written reports.
2. The CONTRACTOR shall furnish ladders, required tools, and men to open fixtures, boxes, panels, or any other equipment to enable the A/E representatives to see into any parts of the installation he may request.
3. The CONTRACTOR shall furnish meters for observation of readings as directed by the A/E representative. Meters to be furnished include: clamp-on type ammeter, voltmeter, megger, and clamp-on type ground resistance tester.

O. Operating Instructions:

1. At the completion of the entire installation, the CONTRACTOR shall arrange to operate each component of systems and then systems as a whole. When all the requirements of the plans and specifications have been met, the CONTRACTOR shall then arrange to instruct the OWNER's operating and maintenance personnel in the correct and proper procedures for the operation and maintenance of the systems

END OF SECTION 260000

SECTION 260500 - BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Supporting devices for electrical components.
2. Cutting and patching for electrical construction.
3. Touchup painting.
4. Firestopping
5. Concrete equipment bases.
6. Electrical demolition.

1.3 SUBMITTALS

A. Product Data:

1. For materials to firestop cable and raceway penetrations of fire-rated floor and wall assemblies.

B. Shop Drawings:

1. UL details for firestopping cable and raceway penetrations of fire-rated floor and wall assemblies.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Stainless steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.

1. Channel Thickness: Selected to suit structural loading.
2. Fittings and Accessories: Products of the same manufacturer as channel supports.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Expansion Anchors:

1. Inside: Carbon-steel wedge or sleeve type.
2. Outside: Stainless-steel wedge or sleeve type.

F. Toggle Bolts:

1. Inside: All steel springhead type.
2. Outside: Stainless-steel springhead type.

2.2 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.3 FIRESTOPPING

A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

2.4 CONCRETE BASES

A. Concrete: 3000-psi, 28-day compressive strength with welded wire fabric reinforcement.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.

C. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces.

3.2 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Selection of Supports: Comply with manufacturer's written instructions.

B. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.4 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate pipe hangers or clamps.

F. Install 1/4-inch- diameter or larger threaded hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

I. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

J. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

K. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Steel: Spring-tension clamps on steel.

6. Light Steel: Sheet-metal screws.
7. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 FIRESTOPPING

A. Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly.

3.6 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated.

3.7 DEMOLITION

A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, 2 inches below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.

D. Remove demolished material from Project site after coordination with the Owner’s representative. Equipment and/or materials that the Owner desires to retain shall be moved to a location designated by the Owner’s representative.

E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.9 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work.

3.10 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint.

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.11 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

END OF SECTION 260500

SECTION 260519 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field Quality-Control Test Reports: From Contractor.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 POWER CONDUCTORS AND CABLES

A. Manufacturers:

1. Cerro Wire LLC.
2. Colonial Wire and Cable.
3. Encore Wire Corporation.
4. General Cable Corporation.
5. Okonite.
6. Prysmian Group.
7. Republic Wire, Inc.
8. Southwire.
9. Or approved equal.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material:

1. Copper complying with NEMA WC70 / ICEA S-95-658 solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
2. Power and lighting circuitry: Minimum conductor size shall be #12, and maximum conductor size shall be #500 kcmil.

D. Conductor Insulation Types: Type THHN/THWN-2 complying with NEMA WC70 / ICEA S-95-658.

2.3 CONTROL CONDUCTORS AND CABLE

A. Discrete control conductors: Copper, stranded, type THHN/THWN-2.

1. Manufacturers:

a. Cerro Wire LLC.
b. Colonial Wire and Cable.
c. Encore Wire Corporation.
d. General Cable Corporation.
e. Okonite.
f. Prysmian Group.
g. Republic Wire, Inc.
h. Southwire.
i. Or approved equal.

2.4 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems.
2. AMP Incorporated/Tyco International.
3. FCI.
4. Greaves Polaris.
5. Hubbell/Anderson.
6. ILSCO.
7. NSI.
8. O-Z/Gedney; EGS Electrical Group LLC.
9. Penn Union.
10. 3M Company; Electrical Products Division.
11. Or approved equal.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

1. For conductors #8 & smaller, use wirenut type twist connectors.
2. For conductors #6 & larger, use pre-insulated solderless connectors with one spare port(s) for future cable connection.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Feeders and Branch Circuits: Type THHN/THWN-2, single conductors in raceway.

B. Discrete Control Circuits: Type THHN/THWN-2, in raceway.

C. Class 1 Control Circuits: Type THHN/THWN-2, in raceway.

3.2 INSTALLATION

A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables, conductors, or raceway.

C. Identify and color-code conductors and cables according to Section 260553 "Electrical Identification."

D. Shared neutral conductors shall not be used unless specifically indicated so on homerun circuitry designations on the drawings.

3.3 CONNECTIONS

A. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Inspect for physical damage; test conductors and cable for continuity and shorts.
3. Megger testing for building wire and cable:
    a. All current carrying phase conductors and neutrals shall be tested as installed, and before connections are made, for insulation resistance and accidental grounds. This shall be done with a 500 volt megger. Megger testers shall not be electronic type. Megger testers shall be hand crank or power driven crank type. Minimum readings between conductors and between conductor and the grounded metal raceway shall be: 25 mega-ohms for #6 wire and smaller; 50 mega-ohms for #4 wire or larger.
    b. The CONTRACTOR shall correct malfunctioning conductors and cables, including replacement if necessary, and retest to demonstrate compliance.
    c. Certify compliance with test parameters.
4. Control / Signal Transmission Media Tests:
    a. Test cable segments for faulty connectors, splices, terminations, and the integrity of the cable and its component parts.
    b. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
4. Provide tabulated megger readings for each panel circuit.

C. Witness Tests:

1. The CONTRACTOR shall furnish a megger and show A/E representative and/or Owner that the conductors and panels comply with the above requirements.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections:

1. Section 264113 "Lightning Protection for Structures" for additional grounding and bonding materials.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Ground rods.
2. Connection / test / inspection wells.

B. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:

a. Chance/Hubbell.
b. Copperweld.
c. Erico Inc.; Electrical Products Group.

d. Framatome Connectors/Burndy Electrical.
e. Galvan Industries.
f. Harger.
g. Heary Brothers Lightning Protection Co.
h. Ideal Industries.
i. ILSCO.
j. Kearney/Cooper Power Systems.
k. Lyncole XIT Grounding.
l. O-Z/Gedney Co.
m. Raco, Inc.
n. Salisbury: W. H. Salisbury & Co.
o. Southern Grounding / South Atlantic LLC.
p. Thomas & Betts.
q. Thompson Lightning Protection.
r. Or approved equal.

2. Connection Test / Inspection Wells:

a. ALT Fabrication.
b. Charles Industries.
c. Harger Lightning Protection, Inc.
d. Heary Brothers Lightning Protection Co.
e. Quazite / Strongewell.
f. PVC piping manufacturers.
g. Or approved equal.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 260519 "Conductors and Cables."

B. Grounding Electrode Conductors: Stranded cable.

C. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

D. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

E. Grounding Bus:

1. Bare, annealed copper bars of rectangular cross section
2. 1/4" thick, 4" wide, length as required
3. Stand-off insulator mounting brackets.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Ground Rods: Sectional type; copper-clad steel, 3/4" diameter by 120 inches in length.

B. Connection / Test / Inspection Wells: Provide handholes as specified below:

1. Cylinder, minimum dimensions of 12" diameter x 19" deep, PVC, with cover.
2. Box, minimum dimensions of 12" x 12" x 12" deep with cover, green PVC or polyethylene.

PART 3 - EXECUTION

3.1 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Exothermic-Welded Connections: Use for connections to ground rods, structural steel and for underground connections.

C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacers; space 1 inch minimum from wall and support 12 inches above finished floor, unless otherwise indicated.

E. Underground Grounding Conductors: Use tinned- copper conductor. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.

1. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6.4-by-50-by-300-mm) grounding bus.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

C. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.

3.3 INSTALLATION

A. Ground Rods: For service entrance, install a minimum of two rods spaced at least twenty feet from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds for connections. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Building Steel: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to building steel. Connect grounding conductors to building steel by exothermic weld.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

END OF SECTION 260526

SECTION 260533 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections:

1. Section 260500 "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
2. Section 262726 "Wiring Devices" for devices installed in boxes.
3. Section 260548 "Seismic Controls for Electrical Work" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. LFMC: Liquidtight flexible metal conduit.

D. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For raceways, fittings, wireways, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting seismic restraints.
2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Section 260548 "Seismic Controls for Electrical Work." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.7 FIELD CONDITIONS

A. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturers:

1. Alflex Inc.
2. Allied Tube and Conduit.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Atkore International / Calbrite.
5. Conduit Pipe Products Company.
6. Electri-Flex Co.
7. Gibson Stainless.
8. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
9. Manhattan/CDT/Cole-Flex.
10. Maverick Tube.
11. O-Z Gedney; Unit of General Signal.
12. Patriot Aluminum Products.
13. Republic Conduit.
14. Shaw Stainless and Alloy.
15. Wheatland Tube Co.
16. Or approved equal.

B. Rigid Aluminum Conduit: Produced to ANSI C80.5; listed to UL 6A.

C. Rigid Steel Conduit: Produced to ANSI C80.1; listed to UL 6.

D. EMT and Fittings: Produced to ANSI C80.3; listed to UL 797.

1. Fittings: Plated-steel, hexagonal, compression type.

E. FMC: Listed to UL 1.

F. LFMC: Listed to UL 360.

G. Fittings:

1. NEMA FB 1; compatible with conduit and tubing materials.
2. Connectors shall have insulated throats or provided with a protective bushing on threads.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco.
4. Blue Diamond Industries.
5. Cantex.
6. Certainteed.
7. Condux International.
8. ElecSYS.
9. Electri-Flex.
10. Heritage Plastics / Atkore International.
11. Lamson & Sessions; Carlon Electrical Products.
12. Manhattan/CDT/Cole-Flex.
13. Queen City Plastics.
14. RACO.
15. Southern Pipe, Inc.
16. Spiralduct, Inc./AFC Cable Systems, Inc.
17. Thomas & Betts.
18. Or approved equal.

B. RNC: Produced to NEMA TC 2; listed to UL 651.

1. Schedule 40 and Schedule 80 PVC.

C. RNC Fittings: Produced to NEMA TC 3; listed to UL 514B; match to conduit or tubing type and material.

2.4 METAL WIREWAYS

A. Listed to UL 870.

B. Manufacturers:

1. Austin.
2. B-Line.
3. Hammond/
4. Hoffman.
5. Milbank.
6. Square D.
7. Thomas & Betts.
8. Unity Manufacturing.

9. Or approved equal.

C. Material and Construction: Sheet metal sized and shaped as indicated.

1. Indoors: NEMA 1.
2. Outdoors: NEMA 3R.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

E. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

F. Wireway Covers:

1. Indoors: Hinged type.
2. Outdoors: Flanged-and-gasketed type.

G. Finish: Manufacturer's standard enamel finish.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Arlington.
2. Austin.
3. B-Line.
4. Cooper Crouse-Hinds.
5. Emerson/General Signal; Appleton Electric Company.
6. Erickson.
7. FSR.
8. Hammond.
9. Hoffman.
10. Hubbell.
11. Milbank.
12. O-Z/Gedney.
13. Peerless.
14. RACO.
15. Robroy Industries.
16. Rose + Bopla.
17. Scott Fetzer Co.; Adalet-PLM Division.
18. Spring City Electrical.
19. Strong.
20. Thomas & Betts.
21. Vynckier.
22. Walker Systems.
23. Woodhead Industries.
24. Or approved equal.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

H. Recessed steel TV box:

1. Power and low voltage applications for flat screen TV's.
2. Recessed space to keep plugs, connectors, and cords inside the box.
3. Non-metallic, paintable white trim plate.
4. Design Basis: Arlington #TVBS Series.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed or Concealed: Rigid aluminum conduit.
2. Concealed: Rigid aluminum conduit.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Indoors:

1. Exposed, Lower than 10' AFF:

a. In Electrical Rooms: EMT.
b. Elsewhere: Rigid aluminum or rigid steel conduit.

2. Concealed: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
4. For grounding electrode conductors: RNC Schedule 80.
5. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

C. Minimum Raceway Size: 3/4-inch trade size (DN 21).

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

E. Do not install aluminum conduits embedded in or in contact with earth or concrete. For direct burial or concrete encasement or penetrations, coat conduit with asphaltum or bitumastic type coating.

F. EMT shall not be installed where raceway or fittings would be in direct contact with the earth, underground, in/below concrete, exposed to the elements, exposed to severe physical damage, or exposed to severe corrosive influence.

3.2 INSTALLATION

A. Keep raceways a minimum of 6 inches away from runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

B. Complete raceway installation before starting conductor installation.

C. Support raceways as specified in Section 260500 "Basic Electrical Materials and Methods."

D. Install temporary closures to prevent foreign matter from entering raceways.

E. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

F. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

G. Conceal raceways within finished walls, ceilings, and floors, unless otherwise indicated.

1. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

H. Conduits installed on the inside face of exterior building walls shall be spaced off the wall surface a minimum of 1/4" using strut-type channel or "clamp-backs".

I. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

K. Use connectors with insulated throats or install insulating bushings to protect conductors.

L. Expansion joints: Where raceways of any type pass a building or structure expansion joint, a standard expansion joint fitting, compatible with the type of raceway being used, shall be provided and installed. Review architectural and structural drawings for locations of expansion joints.

M. Underground raceways:

1. Where turning up to cabinets, equipment, poles, etc.; transition from horizontal underground PVC to rigid metal for elbows & raceway stub-ups.
2. Stub-up Connections to Equipment:

a. Extend conduits through concrete floor/slab for connection to equipment. Install with threaded coupling for installation of plugs set flush.
b. Extend conductors to equipment with rigid metal conduit; FMC or LFMC may be used 6 inches above the floor to equipment subject to vibration or movement.
c. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

N. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.
3. Where using boxes with concentric, eccentric, or over-sized knockouts; provide bonding bushings and jumpers. Size bonding jumpers in accordance with NEC Table 250-122, connecting to the box with ground lugs.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Label each end of pull wires with location of opposite end.

P. Flexible Connections:

1. Use maximum of 72 inches of flexible conduit for lighting fixtures.
2. Use maximum of 24 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors.
3. Use LFMC in damp or wet locations.

Q. Set floor boxes level and flush with finished floor surface.

R. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Final Acceptance.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

1. Exposed threads on galvanized conduits and fittings, shall be coated with galvanizing paint or equivalent protective coating.

END OF SECTION 260533

SECTION 260538 - WIRE MESH CABLE TRAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SECTION INCLUDES:

A. Continuous, rigid, welded steel wire mesh cable management system.

B. Cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories.

1.3 SUMMARY

A. References:

1. IEC 61537- Cable Tray Systems and Cable Ladder Systems for Cable Management.
2. NEMA VE 1-2002/CSA C22.2 No. 126.1-02 – Metal Cable Tray Systems.
3. ANSI/NFPA 70- National Electrical Code (NEC).
4. TIA 569-A- Commercial Building Standard for Telecommunications Pathways & Spaces.
5. ASTM A 510 - Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
6. ASTM A 123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

1.4 SUBMITTALS

A. Comply with requirements of Section 013300 "Submittal Procedures."

B. Product Data: Submit manufacturer’s product data sheets for cable tray indicating dimensions, materials, and finishes, including UL Classification and NEMA/CSA Certification.

C. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer who is licensed in the state where Project is located and who is responsible for their preparation.
2. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions. The term "withstand" means "cable trays will remain in place without separation of any parts when subjected to seismic forces.
3. Design Calculations: Calculate requirements for selecting seismic restraints.
4. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

D. Seismic Qualification Certificates: For cable trays, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70, National Electrical Code, Article 392: Cable Trays; provide UL Classification and labels.

D. Comply with IEC 61537, Cable Tray Systems and Cable Ladder Systems for Cable Management.

E. Comply with NEMA VE 1/CSA C22.2 No. 126.1, Metal Cable Tray Systems, for materials, sizes, and configurations; provide cCSAus Certificate and labels.

1.6 COORDINATION

A. Coordinate layout and installation of cable tray with other installations.

1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.
2. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products shall not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials shall be unpacked and dried before storage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. B-Line.
2. Cablofil, Inc.
3. Chalfant.
4. Code Electric.
5. Hoffmann.
6. MonoSystems.
7. MP Husky.
8. Thomas and Betts.

2.2 MATERIALS AND FINISHES

A. Cable Tray Materials:

1. Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.

B. Cable Tray Finishes:

1. Finish for Carbon Steel Wire after welding and bending of mesh:

a. Electrodeposited Chromium-zinc Plating.

2. Hardware shall match the carbon steel wire cable tray finish.

C. Cable tray will consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat.

D. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

1. Mesh: 2 x 4 inches.
2. Straight Section Lengths: 10 feet.

E. Cable Tray Size: As indicated on the drawings.

2.3 CABLE TRAY SUPPORTS AND ACCESSORIES

A. Fittings/Supports: Wire mesh cable tray fittings shall be field-fabricated from straight tray sections, in accordance with manufacturer's instructions. Supports shall include manufacturer recommended hardware. Place supports so that support span does not exceed manufacturer recommendations or code limitations.

1. Suspended-mounting; from building structure with 3/8" or 1/2" threaded rod. Tray shall be supported from both sides. Center mounted supports are not acceptable. Wall mounted supports as the sole support method are not acceptable. If a wall mounted supports are used, support of the opposite side of the cable tray shall be by suspension from the building structure.
2. Threaded rod shall be covered by smooth metal conduit to a minimum of 12" above the top of the cable tray.
3. Splices as recommended by cable tray manufacturer.
4. Accessories: As required to protect, support, and install a cable tray system. Select from the following accessories, if applicable:

a. Divider Strips, of same material and finish as cable tray, 6 inch.
b. Cable Routing Accessories:

1) Dropout: Bolt to tray; slotted design.
2) Cable exit.

c. Support Accessories:

1) J-Bolt kit to mount tray to 19" or 23" racks.
2) Beam Supports:

a) Beam Clamp: To clamp threaded rod to beam.

3) Supports for Cables:

a) 1/2" x 15' Velcro Roll to bundle cables.

d. Grounding Clamp to ground cable tray.
e. Roller: Cable Pulling Kit.
f. Seismic Bracing Kit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of cable trays. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate layout and installation of cable tray with other installations.

1. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products shall not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials shall be unpacked and dried before storage.

2. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect/Engineer/Owner.

3.3 INSTALLATION

A. Install cable tray level and plumb according to manufacturer's written instructions, coordination drawings, original design, and referenced standards.

1. Cutting: Field-fabricate changes in direction & elevation by cutting & bending cable tray.

a. Cut cable tray wires in accordance with manufacturer’s instructions.
b. Cable tray wires must be cut with side-action bolt cutters with offset head to ensure integrity of protective galvanic layer.
c. Remove burrs and sharp edges from cable trays.

B. Install cable tray, so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

C. Install cable tray, so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Fasten cable tray supports to building structure and install seismic restraints.

E. Design fasteners and supports to carry cable tray, cables, and a concentrated load of 200 lb. Comply with seismic-restraint details according to Section 260548 "Seismic Controls for Electrical Systems."

F. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.

G. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed recommended dimensions. Space connectors and set gaps according to applicable standard.

H. Seal penetrations through fire and smoke barriers.

I. Install cable trays with enough workspace to permit access for installing cables.

3.4 CABLE TRAY GROUNDING

A. Ground cable trays according to NFPA 70 unless additional grounding is specified.

B. Cable trays with communications cable shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications are separated from power circuits by installation in separate cable trays.
4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.

5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.

END OF SECTION 260538

SECTION 260548 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.
5. Adhesive anchor bolts.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For each seismic-restraint device.

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic and wind forces required to select seismic and wind restraints and for designing vibration isolation bases.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Seismic- and Wind-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements, including the testing requirements of the 2012 North Carolina Building Code, Section 1708.4.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic restraint requirements in 2012 North Carolina Building Code, Section 1613, unless requirements in this Section are more stringent.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Seismic Design Category: At the time of specification preparation, Seismic Design Category was designated as C. Verify with the final project Code Summary drawing and structural drawings.

B. See the project Code Summary drawing and structural drawings for additional building construction criteria.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed: Obtain value from Figure 1609, North Carolina Basic Wind Map, in the 2018 North Carolina Building Code.
2. Building Classification Category: See the project Code Summary drawing and structural drawings.
3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by maximum area of equipment component projected on vertical plane normal to wind direction and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Seismic Design Category: At the time of specification preparation, Seismic Design Category was designated as C. Verify with the final project Code Summary drawing and structural drawings.

2.2 RESTRAINT CHANNEL BRACINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a Division of Cooper Industries.
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; Atkore International.

B. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kinetics Noise Control, Inc.
2. Loos & Co., Inc.
3. Vibration Mountings & Controls, Inc.

B. Restraint Cables: ASTM A 603 galvanized -steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a Division of Cooper Industries.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.
4. TOLCO; a brand of NIBCO INC.

B. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.

C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

D. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a Division of Cooper Industries.
2. Hilti, Inc.
3. Kinetics Noise Control, Inc.
4. Mason Industries, Inc.

B. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Note: Expansion-type anchor bolts are not permitted by ASCE/SEI 7 for nonisolated equipment in excess of 10 hp (7.46 kW).

2.6 ADHESIVE ANCHOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hilti, Inc.
2. Kinetics Noise Control, Inc.
3. Mason Industries, Inc.

B. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.

B. Coordinate concrete bases with building structural system.

3.3 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.4 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork.

B. Equipment and Hanger Restraints:

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.6 FIELD QUALITY CONTROL

A. The Professional Engineer retained for seismic restraint calculations shall visit the job site as necessary to comply with the Special Inspections requirement of the North Carolina Building Code, Section 1707. This engineer shall provide in writing verification of compliance of the installation with the approved seismic submittal. This verification shall be submitted as a Special Inspections Report and shall bear the Engineer’s professional seal. Job site inspections by other than this engineer are not acceptable.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative (if required):

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect / Engineer, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect / Engineer's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect / Engineer.
5. Test to 90 percent of rated proof load of device.

C. Seismic controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes electrical identification materials and devices intended to comply with NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

A. Product Data:

1. For each electrical identification product indicated.
2. For double coated, adhesive tape product indicated.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 CABLE LABELS

A. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches.

B. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend indicating type of underground line.

2.2 NAMEPLATES AND SIGNS

A. Engraved Plastic Nameplates and Signs: Engraving stock, plastic laminate, minimum 1/16” thick for signs up to 20 sq. in. and 1/8” thick for larger sizes.

B. Fasteners for Nameplates and Signs:

1. High performance, double coated tape with adhesive. Design Basis: 3M #06383, or approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Circuit Identification Labels on Boxes: Panel and circuit number.

1. Interior Boxes:

a. Exposed: Pressure-sensitive, self-adhesive plastic label on cover.
b. Concealed:

1) Pressure-sensitive, self-adhesive plastic label on cover; or
2) Permanent marker on cover, legible by Architect, Engineer, and Owner.

2. Exterior Boxes:

a. Engraved plastic label on cover; and
b. Pressure-sensitive, self-adhesive plastic label inside cover.

F. Color-Coding of Phase, Neutral, and Ground Conductors: Use the following colors for service, feeder, and branch-circuit phase conductors:

Configuration	Phase A	Phase B	Phase C	Neutral	Ground
120/208-V, 3 Ph, 4W	Black	Red	Blue	White	Green
277/480-V, 3 Ph, 4W	Brown	Orange	Yellow	Gray	Green

2. For conductors #6 AWG and smaller, factory apply color the entire length of conductors.
3. For conductors #4 AWG and larger, field apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
4. At each panelboard, a color code legend shall be permanently posted corresponding to the conductors and voltage in that panelboard.

G. Apply identification to conductors as follows:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
3. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

H. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment unless units are delivered with their own self-explanatory identification. Attached engraved labels with high performance double coated adhesive tape. Apply labels for each unit of the following categories of equipment:

1. Switchgear, switchboards, panelboards, electrical cabinets, and enclosures.
2. Access doors and panels for concealed electrical items.
3. Disconnect switches and enclosed circuit breakers.
4. Transformers.
5. Inverters.
6. Contactors.
7. Remote-controlled switches.
8. Control devices and push-button stations.
9. Motor-control centers and motor starters
10. Fire alarm control panels, master stations, control panels, local operator consoles, and power supplies.
11. Public address, intercom, and paging system equipment.

I. Nameplate colors shall be: White surface with black core.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following lighting control devices:

1. Outdoor photoelectric switches.
2. Switchbox-mounted occupancy and vacancy sensors.
3. Indoor occupancy and vacancy sensors.
4. Multipole contactors.

1.3 DEFINITIONS

A. PIR: Passive infrared.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS

A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.3 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers:

1. Area Lighting Research, Inc.
2. Fisher Pierce.
3. Grasslin Controls Corporation.
4. Intermatic, Inc.
5. Paragon Electric Co.
6. TORK.
7. Touchplate Technologies, Inc.
8. Watt Stopper (The).

B. Description: Solid state, with dry contact rated for integral fixture load, and complying with UL 773A.

C. Light-Level Monitoring Range: 1.5 to 10 fc (16 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.

D. Time Delay: 15-second minimum, to prevent false operation.

E. Surge Protection: Metal-oxide varistor type, complying with IEEE C62.41 for Category A1 locations.

F. Mounting: Integral to fixture controlled.

2.4 SWITCHBOX-MOUNTED OCCUPANCY AND VACANCY SENSORS

A. Manufacturers:

1. Cooper Controls.
2. Hubbell Lighting Inc.
3. Leviton Mfg. Company Inc.
4. Watt Stopper (The).

B. Description: Dual technology, ultrasonic and PIR type, with integral power-switching contacts rated for 800 W at 120-V ac and 1200 W at 277-V ac, minimum; suitable for electronic ballasts, LED drivers, or 1/6-hp motors.

1. Configurable occupancy sensing or vacancy sensing operating modes. Operation:
    a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Include ground wire.

C. Single Relay Unit: Device contains one relay for controlling load circuit.

1. Design Basis: Hubbell # LHMTS1.
2. One On-Off button for manual control.

D. Dual Relay Unit: Device contains two relays for controlling independent lighting loads or circuits.

1. Design Basis: Hubbell #LHMTD2.
2. Two On-Off buttons for manual control.

E. Dimmer Unit:

1. Design Basis: Legrand / WattStopper #DW-311.
2. Dimming Control Signal: 0-10 VDC.
3. Suitable for multi-way control from up to four locations.

2.5 INDOOR OCCUPANCY AND VACANCY SENSORS

A. Manufacturers:

1. Cooper Controls.
2. Hubbell Lighting Inc.
3. Leviton Mfg. Company Inc.
4. Watt Stopper (The).

B. General Description: Wall- or ceiling-mounting, as indicated on the drawings; solid-state units with a separate relay unit.

1. Configurable occupancy sensing or vacancy sensing operating modes. Operation:
    a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
    b. Vacancy Sensor: Unless otherwise indicated, lights are manually turned on and sensor turns lights off when the room is unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Units: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
    a. Where indicated for 277-V ac lighting systems, provide additional relay units where required for simultaneous control of 120-V ac exhaust fans.
4. Mounting:
    a. Sensor: Suitable for mounting in any position on a standard outlet box.
    b. Relay: Externally mounted though a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
    c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (215 to 2150 lx); keeps lighting off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in., and detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.

D. Design Basis: Hubbell # OMNIDT2000. If room size is significantly smaller than 2000 sq. ft., evaluate the use of a unit with applicably sized reduced range.

2.6 MULTIPOLE CONTACTORS

A. Manufacturers:

1. Allen-Bradley/Rockwell Automation.
2. Cutler-Hammer; Eaton Corporation.
3. GE Industrial Systems.
4. Siemens.
5. Square D.

B. Description: Electrically operated and mechanically held, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Control-Coil Voltage: Match control power source.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Install and aim sensors in locations to achieve at least 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Conductors and Cables."

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to control device manufacturer's written instructions.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Electrical Identification."

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational Test: Verify actuation of each sensor and adjust time delays.

B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 6 months from date of Final Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.

END OF SECTION 260923

SECTION 260943 - NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Networked Central Lighting Control systems. Systems are composed of:
    a. Network integrated dimming systems.
    b. Automation control processors.
    c. Sensors
    d. User Interfaces:
        1) Keypad
2. System Functions and Sequences

B. Related Section:

1. Section 260500 “Basic Electrical Materials and Methods”

1.02 REFERENCES

A. Definitions:

1. Control: Effecting a change in state by one PC program onto a microprocessor or device.
2. Scene: Predetermined light level of a single fixture of group of fixtures.
3. RS-485: A serial network protocol complying with TIA-485-A.
4. UTP: Unshielded twisted pair.

C. Reference Standards:

1. National Fire Protection Association (NFPA): NFPA 70 - National Electrical Code.
2. Underwriters Laboratories (UL): UL 508 - Industrial Control Equipment

1.03 SYSTEM DESCRIPTION

A. Web Accessible, network connected, lighting control system utilizing preset control software, central signal microprocessor, lighting control panel including integrated branch circuit protection, dimming modules control mModules, and sensors.

B. System Components: System includes the following addressable components:

1. Keypad controls.
2. Timed room lighting.
3. Daylight compensating lighting controls.
4. Occupancy Sensors.

1.04 SUBMITTALS

A. Product Data: For each type of product required for complete network lighting control system, demonstrating compliance with requirements.

B. Shop Drawings:

1. Schematic diagram showing complete network lighting control system and accessories.
2. Circuits and emergency circuits with capacity and phase, control zones, load type and voltage per circuit.

1.05 CLOSEOUT SUBMITTALS

A. Operating and maintenance instructions.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualification: Manufacturer of network lighting controls with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

B. Source Requirements: Provide Network Lighting System through a single source from a single manufacturer.

C. Manufacturer Qualifications: Approved manufacturer of network lighting controls listed in this Section with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.

1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:

   a. Product data, including certified independent test data indicating compliance with requirements.
   b. Samples of each component.
   c. Sample submittal from similar project.
   d. Project references: Minimum of 5 installations not less than 5 years old, with Owner and Architect contact information.
   e. Sample warranty.

2. Substitutions following award of contract are not allowed except as stipulated in Division 01 General Requirements.
3. Approved manufacturers must comply with separate requirements of Submittals Article.

D. Electrical Components, Devices, and Accessories: UL listed and labeled per NFPA 70.

1.07 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of modular dimming controls system the fail in materials or workmanship within the specified warranty period following substantial completion.

1. Warranty Period: Touch screen display and overlay components: 1 year.
2. Warranty Period: Disc drives and other moving parts, and power supplies: 1 year.
3. Warranty Period: Other components, up to 8 years as per warranty contract.

B. Manufacturer's Extended Support Service: Extended telephone support: Unlimited period.

PART 2 - PRODUCTS

2.01 SPACE BUILDER

A. Manufacturers:

1. Basis-of-Design Manufacturer: Crestron Electronics, comparable products from ETC Controls, or equivalent pre-approved by Architect prior to bidding, with the following components and characteristics.

B. Contractor shall provide the lighting control systems as called out herein and shown on the Contract Drawings with the following additional features

C. Each space shall be factory packaged with the load controller, keypads, sensors, and additional accessories necessary for a completely working space. There shall be separate containers for rough-in and trim materials. The box shall be labeled with the space type.

D. Each space shall be factory configured to operate when installed by the Contractor. On-site configuration shall only be required for sensor tuning and scene setting.

E. Each space shall be autonomous in its control and shall not rely on centralized processors for standard operations.

F. Products:

1. Design Basis: Crestron SpaceBuilder GLPP.

2.02 1-3 ZONE LIGHTING CONTROLLER

A. Manufacturers:

1. Basis-of-Design Manufacturer: Crestron Electronics, comparable products from ETC Controls, or equivalent pre-approved by Architect prior to bidding, with the following components and characteristics.

B. Lighting controller shall be a surface-mounted industrial control enclosure mounts directly on two side by side 4” square electrical junction boxes, suitable for concealed locations. Lighting controller shall have flying leads with wing nut type connections.

C. Circuit Input: 100 – 277 VAC, 50/60 Hz. Input, one 16 amp

D. Zone Outputs:

1. 1, 2, or 3 high inrush mechanically held relays for switching loads

a. 1,000,000 cycle mechanically latching relays
b. Zero-cross arc-less high inrush
c. Air gap off protection on each channel

2. 0-10v dimming models shall include 0-10v 4 wiring dimming for each channel

E. Product:

1. Design Basis: Crestron GLPP-DIMFLVCN-PM (1 zone 0-10v dimming with power monitoring)

2. Design Basis: Crestron GLPP-1DIMFLVCN2-PM (2 zones 0-10v dimming with power monitoring)
3. Design Basis: Crestron GLPP-1DIMFLVCN3-PM (3 zones 0-10v dimming with power monitoring)

F. Design Basis: GLPP SPECIFIC ACCESSORIES.

1. Keypads:

a. Connects to lighting controller with class II (2) #18 AWG or greater conductors.
b. Color shall be white.
c. Scene Functions:

1) ROCKER (ON/OFF/hold to dim) or 4 Button (ON/SCENE 1/SCENE 2/OFF).

a) Product: Design Basis: Crestron GLPPA-KP-W-S.

2.03 CENTRALIZED PANEL SOLUTIONS

A. Manufacturers:

1. Basis-of-Design Manufacturer: Crestron Electronics, comparable products from ETC Controls, or equivalent pre-approved by Architect prior to bidding, with the following components and characteristics.

B. Panel Characteristics:

1. Panel shall be digitally addressable using serial or Ethernet communication from Control Processor Panel specified hereto after.
2. Lighting dimmers shall be compatible with drivers / ballasts and LEDs / lamps as listed in Section "LED Interior Lighting."
3. Dimmers shall be provided in quantities, control types, and rated for the connected load as shown on the Contract Drawings.
4. Line and load phases shall be coordinated per manufacturers recommendations.
5. Dimming modules shall be field replaceable.
6. Dimming panels shall be listed to UL508.
7. Lighting control panels shall be convection cooled without the use of moving parts.
8. Lightning Protection: can withstand 6 kV / 3 kA surge, as per IEC 61000-4-5 and ANSI/IEEE C62.41-1991
9. NEMA Type 1 enclosure, IP20 rated protection, for indoor use only; 16-gauge galvanized steel, surface wall mount; gray front cover with powder coated finish
10. Lighting control panels shall comply with NEMA PB 1 and UL 50 (CAN/CSA C22.2, No. 94), UL 67 (CSA C22.2, No. 29), UL 489 (CAN/CSA C22.2, No. 65), and UL 916 (CSA C22.2, No. 205).

C. Feed Types:

1. Reference Contract Drawing schedules for required feed types and breaker ratings.
2. MAIN LUG ONLY (MLO)

a. 480Y/277V 3-phase, 4-wire

1) 20 amp thermal magnetic branch circuit breakers
2) AIC rated to 22,000A

D. Zone Control Modules:

1. 4-Wire 0-10v Dimming

    a. Use for any 4-wire 0-10v dimming load
    b. Zero-cross arc-less high inrush
    c. Air gap off protection on each channel

2.04 USER INTERFACES

A. Manufacturers:

1. Basis-of-Design Manufacturer: Crestron Electronics, comparable products from ETC Controls, or equivalent pre-approved by Architect prior to bidding, with the following components and characteristics.

B. Keypads:

1. Provide keypad quantities and locations as specified herein and shown on the Contract Drawings.
2. Field-configurable remote keypad with auto-adjusting backlight illuminating replaceable, engraveable programmable buttons in number indicated, with white LED indicators, configured to fit in standard single-gang box.
3. Trimmed using decorator face plates.
4. Cresnet connected for power and communication
5. Maximum buttons: 8
6. Color shall be white.
7. Product: Design Basis: Crestron C2N-CBD-P-W-S

C. DMX Interface:

1. Provide interface to allow Crestron controller and timeclock functions to send signal to third party DMX controller.
2. Product: Design Basis: Crestron C2N-IO

2.05 SENSORS

A. Manufacturers:

1. Basis-of-Design Manufacturer: Crestron Electronics, comparable products from ETC Controls, or equivalent preapproved by Architect prior to bidding, with the following components and characteristics.
2. Contractor shall provide quantities and locations of sensors per the Contract Drawings and as required for turnkey commercial lighting control operation.

B. Daylight Sensors:

1. Indoor Daylight Sensor (open loop)

    a. Continually monitors daylight entering window or skylight to enable daylight harvesting applications to provide control of room lighting based on presence of daylight. Equipped with 3-wire interface for direct connection to control system utilizing control processor; 24 VDC power from network control bus.
    b. Light sensitivity: 3 to 6,000 foot-candles.
    c. Mounting: Ceiling surface mounted.
    d. Product: Design Basis: Crestron GLS-LOL.

C. Sensor Interface Module:

1. Sensor Interface Device: Integrates sensors with control network. In separate enclosure. 4-wire bus providing 24 VDC power to network devices, with two independent sensing inputs.
2. Product: Design Basis: Crestron GLS-SIM.

2.06 CONTROL PROCESSOR PANEL

A. Manufacturers:

1. Basis-of-Design Manufacturer: Crestron Electronics, comparable products ETC Controls, or equivalent pre-approved by Architect prior to bidding, with the following components and characteristics.

B. Control Processor Panels shall be provided in quantities and locations per the Contract Drawings, or as required for a fully networked lighting control system.

C. Control Processor Panels shall be factory assembled in a UL508 panelshop.

D. Shall include but not be limited to the following equipment to support all lighting control devices.

1. Cabinets:

a. Cabinet shall be made of 16-gauge galvanized steel
b. NEMA 1 rated.
c. All DIN rails and mounting accessories shall be furnished and properly installed.
d. Product: Design Basis: Crestron DIN-EN.

2. Processors:

a. Design Basis: Crestron 3-series control system.
b. Modular architecture supports multiple simultaneous running programs.
c. Ethernet 10/100Base-T and Cresnet connected
d. Astronomical time clock with events stored in non-volatile RAM
e. Native BACnet/IP with support for up to 500 BACnet objects
f. Built-In Web Server: IIS v.6.0
g. SNMP remote management.
h. Active Directory support.
i. IPv6 ready.
j. DHCP and DNS Support
k. Native Email Client
l. Remote Diagnostics
m. Remote Program Loading and Administration
n. SSL security plug in
o. Support user assigned or dynamic IP address.
p. Products

1) Design Basis: Crestron DIN-AP3.
2) Design Basis: Crestron RMC3.

3. Power Supplies:

a. Provide regulated 24 VDC power supplies as required to support lighting control equipment.
b. 120 VAC input
c. Product: Design Basis: Crestron DIN-PWS60.

4. Hubs:

a. Provide Cresnet distribution hubs as required to support all Cresnet devices.

b. Product: Design Basis: Crestron DIN-HUB.

2.07 PROGRAMMING AND CONFIGURATION SOFTWARE

A. Lighting system configuration software shall allow custom programming of embedded operating systems for control of lighting system.

B. Lighting system configuration software shall Provide a graphical symbol-based programming and development environment.

C. The Lighting System Configuration software shall generate Custom Software Control Interface Modules for communication with compatible remote integrated systems.

D. The Custom Software Control Interface shall include the following control data:

1. Complete lighting system control functions.
2. System specific control sets for sub systems and supervisory systems.
3. The Custom Software Control Interface shall be capable of communicating the following data types:

a. Bidirectional digital and analog data communication.
b. Bidirectional serial data communication.

2.08 CONDUCTORS AND CABLING

A. Power Supply Side of Remote-Control Power Sources: Comply with requirements of Section 260519 "Conductors and Cables."

B. UTP Cable: 100-ohm, UTP. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

C. Communications Control Cable, Non-Plenum Rated: 22 AWG data pair stranded bare copper, and 18 AWG power pair stranded bare copper, Type CM.

1. Product: Design Basis: Crestron CRESNET-NP.

D. Communications Control Cable, Plenum Rated: 22 AWG data pair, stranded bare copper and 18 AWG power pair, stranded bare copper, Type CMP, complying with NFPA 262.

1. Product: Design Basis: Crestron CRESNET-P.

E. Communications High-Power Control Cable, Non-Plenum Rated: 22 AWG stranded bare copper data pair, and 12 AWG stranded bare copper power pair, Type CM.

1. Product: Design Basis: Crestron CRESNET-HP-NP.

PART 3 - EXECUTION

3.01 FIXTURE TESTING

A. Contractor shall provide lighting control factory test reports for each fixture specified on this project.

B. Fixtures already tested and listed in the factory database do not require re-testing.

C. Test report shall include:

1. Confirmation of compatibility with control device.
2. Dimming Range.
3. Performance notations.

D. Crestron factory fixture compatibility testing information may be found here: http://www.crestron.com/resources/lighting-fixture-compatibility

3.02 ENGRAVING

A. Keypad buttons shall be factory engraved using laser technology.

B. Initial shipment of keypads shall be factory engraved per the sequence of operations specified herein and shown on the Contract Drawings.

C. Custom keypad engravings shall be provided as part of the close out procedures.

3.03 BMS INTEGRATION

A. The lighting control system shall be integrated with the BMS system as specified in Division 23.

B. Communication shall occur using BACnet/IP.

C. Contractor shall provide licenses for each the following objects shall be shared with the BMS system:

1. Occupancy Status.
2. Zone On/Off/Dim.
3. Photocell reading.

D. The lighting control system shall also accept time clocked events from the BMS system.

E. Provide necessary coordination labor for integration of all BACnet objects listed hereto before.

3.04 SYSTEM FUNCTIONS AND SEQUENCES

A. System Control Functions: The system shall be capable of the following lighting control functions:

B. Scene Creation: Store levels of selected fixture circuits in preset groups.

C. Scene Recall: Recall previously stored scenes.

D. Off: All zones off.

E. Dim up/down: Raise/lower level of all zones.

F. Password Entry: Enter password to enable touch screen control access.

G. Room/Zone Selection: Select room, zone or area to be controlled.

H. Shade Control: Raise or lower room shades.

I. Event Scheduler: Select times for scenes to be automatically recalled.

3.05 USER INTERFACE CONTROL FUNCTIONS

A. The Keypad interface shall be capable of the following system control functions:

1. Scene Recall
2. Off
3. Dim up/down

B. Touch Screen and Virtual Touch Screen: Touch Screen and Virtual Touch Screen interfaces shall be capable of the following system control functions:

1. Password Entry
2. Multiple levels
3. Room/Zone Selection
4. Scene Recall
5. Dim up/down
6. Shade Control
7. Scene Recall
8. Event Scheduler
9. Customer logo and color scheme

C. Optional Control Sequences for Advanced Control:

1. Occupancy adjustments
2. Timeout
3. Control logic (occupancy or vacancy sensor)
4. Lighting Scenes
5. Custom scene adjustment through sliders and press+hold operation
6. Individual zone control override
7. Timeclock Adjustment
8. Modify timeclock activation schedule
9. Select/unselect pre-programmed timeclock events
10. Display all timeclock events
11. Daylight Harvesting Adjustments
12. Minimum dim level
13. Response time
14. Zone control
15. Scene Recall
16. Fade time
17. Color scene recall and saving

3.06 TIME CLOCK EVENTS

A. The lighting control system shall have astronomical time clocked events. 6 time clock events shall be provided.

B. End User shall have the option to create additional time clock events via touch screen or XPanel interfaces.

3.07 INSTALLATION

A. Prior to installation, examine work area to verify measurements, and that commencing installation complies with manufacturer's requirements.

B. Comply with requirements of Section 260000 "Electrical, Basics."

C. Do not install network power controls until space is enclosed, HVAC systems are running, and overhead and wet work in space are complete.

D. Install network power switching controls in accordance with manufacturer's instructions.

E. Grounding: Provide electrical grounding in accordance with NFPA 70.

3.08 MANUFACTURER SUPPORTED SERVICES

A. Pre-Wire:

1. Manufacturer shall provide on-site visit during the rough-in stage of the installation. At this time wiring topologies and terminations shall be reviewed with the Contractor.

B. Startup:

1. Provide manufacturer's system startup and adjustment.
2. Switch each load on and off with manual line test feature of the power switching module before installing processors.
3. Perform operational testing to verify compliance with Specifications. Adjust as required.

C. Tuning:

1. Within 12 months of the date of Substantial Completion provide onsite service to adjust the system to account for actual occupied conditions.

D. Training:

1. Factory authorized service representative to instruct owner's staff to adjust, operate and maintain network power switching systems; and provide instruction using the system software.
2. Demonstration: Schedule demonstration with Owner.
3. Training: Train Owner's personnel to operate, maintain, and program network power switching systems. Allow for a minimum of trips to the jobsite to provide additional training as needed.
4. Furnish set of approved submittals, and record drawings of actual installation for Owner's personnel in attendance at training session.

END OF SECTION 260943

SECTION 262200 - DRY-TYPE TRANSFORMERS (600 V AND LESS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

1.3 SUBMITTALS

A. Product Data Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer indicated.

B. Manufacturer Seismic Qualification Certification: Submit certification that transformer assembly and components will withstand seismic forces defined in Section 260548 "Seismic Controls for Electrical Work." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
3. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
4. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
5. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C 57.12.91, “Standard Test Code for Dry-Type Distribution and Power Transformers”.

C. Comply with IEEE C 57.96, “Guide for Loading Dry-Type Distribution and Power Transformers”.

D. Comply with IEEE C 57.110, “Recommended Practice for Establishing Transformer Capability When Supplying Nonsinusoidal Load Currents”.

E. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of wall-mounting and structure-hanging supports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Electric Corporation; Power Distribution Products Division.
2. Eaton / Cutler-Hammer.
3. GE Electrical Distribution & Control.
4. Hammond Power Solutions.
5. Siemens Energy & Automation, Inc.
6. Sola/Hevi-Duty Electric.

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices, except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum or copper.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Provide transformers that are internally braced to withstand seismic forces specified in Section 260548 "Seismic Controls for Electrical Work."

C. Cores: One leg per phase.

D. Enclosure:

1. Indoors: Ventilated, NEMA 250, Type 2.
2. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

E. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection"; Finish Color: Gray.

F. Efficiency: Meet or exceed DOE 2016 efficiency standards.

TRANSFORMER ENERGY EFFICIENCLY LEVELS			
Single-Phase		Three-Phase	
kVA	Efficiency	kVA	Efficiency
15	97.7	15	97.89
25	98.0	30	98.23
37.5	98.2	45	98.40
50	98.3	75	98.60
75	98.5	112.5	98.74
100	98.6	150	98.83
167	98.7	225	98.94
250	98.8	300	99.02
333	98.9	500	99.14
---	---	750	99.23
---	---	1000	99.28

G. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise.

H. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

I. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls and floors for suitable mounting conditions where transformers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install floor-mounting transformers level on concrete bases. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit and 4 inches high. Reinforce concrete bases with welded wire fabric.

B. Install rack mounted transformers as detailed.

C. Anchor transformers to concrete bases and racks according to manufacturer's written instructions, seismic codes at Project, and requirements in Section 260548 "Seismic Controls for Electrical Work."

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding."

B. Connect wiring according to Section 260519 "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 ADJUSTING

A. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 262200

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. RMS: Root mean square.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Trim types and details.
c. Bus configuration, current, and voltage ratings.
d. Short-circuit current rating of panelboards and overcurrent protective devices.
e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Seismic Controls for Electrical Work." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Panelboard Schedules: For installation in panelboards.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. If Section 017823 "Operation and Maintenance Data" is included in the project manual, in addition to items there, include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device.
3. Circuit breaker trip settings.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are typically based on Square D products. Products of other manufacturers are acceptable if they can be installed in the space indicated.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Architect/Engineer/Owner no fewer than two weeks in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Six spares for each type of panelboard cabinet lock.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, and Accessories:

    a. Eaton Corporation; Cutler-Hammer Products.
    b. General Electric Co.; Electrical Distribution & Protection Div.
    c. Siemens Energy & Automation, Inc.
    d. Square D.

2.2 MANUFACTURED UNITS

A. Enclosures: Flush- and surface-mounted cabinets, as scheduled in the drawings. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.
2. Front Hinged Trim: Entire front trim hinged to box with full-length piano hinge, and with standard door within hinged trim cover.
3. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
4. Directory Card: With transparent protective cover, mounted in metal frame, inside panelboard door.

B. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

C. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Compression type.

D. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices. These locations will be indicated as SPACE on the panel schedules in the drawings.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Circuit breaker, where scheduled.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Electronic trip-unit circuit breakers shall have RMS sensing; field-replaceable rating plug; and with the following field-adjustable settings:

a. Instantaneous trip.
b. Long- and short-time pickup levels.
c. Long- and short-time time adjustments.
d. Ground-fault pickup level, time delay, and I^2t response.

3. GFCI Circuit Breakers: Single- and two-pole configurations

a. 5-mA trip sensitivity for personnel protection.
b. 30-mA trip sensitivity for equipment protection.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
5. Shunt Trip: Where required or indicated, 120-V trip coil energized from separate circuit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mount top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Install overcurrent protective devices and controllers. Set field-adjustable circuit-breaker trip ranges.

E. Panel breaker configurations shall be installed as indicated on the panel schedules or as noted. Breaker position revisions will not be accepted unless approved in writing by the Engineer.

F. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

G. Install filler plates in unused spaces.

H. Install overcurrent protective devices.

1. Set field-adjustable switches and circuit-breaker trip ranges.
2. Prepare documentation of circuit breaker trip settings for Owner record documents.

I. Comply with mounting and anchoring requirements specified in Section 260548 "Seismic Controls for Electrical Work."

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 260553 "Electrical Identification".

B. Create a directory to indicate installed circuit loads. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with laminated-plastic nameplate mounted as specified in Section 260553 "Electrical Identification".

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding."

B. Connect wiring according to Section 260519 "Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.
3. Neutral–ground bond testing: After all fixtures, devices and equipment are installed and all connections completed to each panel, the CONTRACTOR shall disconnect the neutral feeder conductor from the neutral bar and take a megger reading between the neutral bar and grounded enclosure. If this reading is less than 25 mega-ohms, the CONTRACTOR shall disconnect the branch circuit neutral wires from the neutral bar. The CONTRACTOR shall then test each one separately to the panel until the low reading ones are found. The CONTRACTOR shall correct troubles, re-connect, and re-test until at least 25 mega-ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in manufacturer’s installation instructions for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Single and duplex receptacles and ground-fault circuit interrupter receptacles.
2. Single- and double-pole snap switches and dimmer switches.
3. Device wall plates.
4. Poke-through assemblies.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Bryant Electric, Inc./Hubbell Subsidiary.
b. Eagle Electric Manufacturing Co., Inc.
c. Hubbell Incorporated; Wiring Device-Kellems.
d. Leviton Mfg. Company Inc.
e. Lutron.
f. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.

B. Straight-Blade and Locking Receptacles:

1. Heavy-Duty grade.
2. Arranged for back and side wiring with brass screws.
3. Grounding type with hex head ground screw terminal.
4. 15-amp and 20-amp, 125-Volt and 250-Volt receptacles in damp or wet locations shall be listed weather-resistant type.
5. Receptacles shall accommodate back and side wiring and shall be grounding type with separate single or double grounding screw terminals.

C. GFCI Receptacles:

1. Straight blade, feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle.
2. Comply with UL 498 and UL 943.
3. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter.
4. For devices indicated, provide units with integral audible unit that sounds an alarm to indicate that the device is tripped.

2.3 SWITCHES

A. Single- and Double-Pole Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches:

1. Heavy-Duty grade, quiet type without the use of mercury switches.
2. Arranged for back and side wiring with brass screws.
3. Grounding type with hex head ground screw terminal.

C. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on/off switches and audible frequency and EMI/RFI filters.

1. Control: Continuously adjustable slider; with single-pole or three-way switching to suit connections.
2. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 10 percent of full brightness.

2.4 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch- (1-mm-) thick, satin-finished stainless steel.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Wet Locations: Cast aluminum, weatherproof, "in-use" type. Receptacle box covers shall be weatherproof whether or not a cord & plug are inserted or not.
5. Toggle Switch Serving as a Disconnect: Wallplate shall be configured with brackets on both sides of the switch to accommodate a padlock to secure the switch in the Off position.

2.5 POKE-THROUGH ASSEMBLIES

A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multi-channeled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.

B. Standards: Comply with scrub water exclusion requirements in UL 514.

C. Service-Outlet Assembly: Flush type with two or four simplex receptacles as indicated on the drawings. Configured with space for four RJ-45 jacks, complying with requirements in Section 271500 "Communications Horizontal Cabling."

D. Size: Selected to fit nominal or 4-inch cored holes in floor and matched to floor thickness.

E. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.

F. Wiring Raceways and Compartments:

1. Power: 3/4” minimum conduit.
2. Communications: 1-1/2” minimum conduit.

G. Cover: Round, cast metal.

2.6 FINISHES

A. Color:

1. Exterior: Brown.
2. Ramp Level Baggage Handling Areas: Brown.
3. Ticket Level, Ticketing Area: White.
4. Ticket Level, Airline Administrative Areas: White.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Install tamper-resistant receptacles at locations as required by the NEC and/or the local authority having jurisdiction.

C. Install wall dimmers to achieve indicated rating after derating for ganging according to manufacturer's written instructions.

D. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' written instructions.

E. Arrangement of Devices: Mount flush unless noted otherwise:

1. Receptacles over counters, backsplashes, etc. shall be mounted with long dimension horizontal.
2. Otherwise, unless noted differently, mount with long dimension vertical, and with grounding terminal of receptacles on top.
3. Group adjacent switches under single, multigang wall plates.

F. Remove wall plates and protect devices and assemblies during painting.

G. Coordinate final placement of poke-through locations with Architect and Owner.

3.2 IDENTIFICATION

A. Comply with Section 260553 "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped / thermal printing with black-filled lettering on face of plate, and durable wire markers inside outlet boxes.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding."

B. Connect wiring according to Section 260519 "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers.
4. Enclosures.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. HD: Heavy duty.

C. RMS: Root mean square.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Manufacturer Seismic Qualification Certification: Submit certification that enclosed switches and circuit breakers, accessories, and components will withstand seismic forces defined in Section 260548 "Seismic Controls for Electrical System." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
    b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. If Section 017823 "Operation and Maintenance Data" is included in the project manual, in addition to items there, include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Hubbell.
4. Legrand.
5. Siemens Energy & Automation, Inc.
6. Square D/Group Schneider.

B. Fusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and defeatable door interlocks when the operating handle is in the "ON" position. Short-circuit withstand ratings of 100kA or 200kA require Class R or Class J rejection fuse block feature.

C. Nonfusible Switch, 1200 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and defeatable door interlocks when the operating handle is in the "ON" position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.

2.3 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. General Electric Co.; Electrical Distribution & Control Division.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

    a. Instantaneous trip.
    b. Long- and short-time pickup levels.
    c. Long- and short-time time adjustments.
    d. Ground-fault pickup level, time delay, and I^2t response.

3. GFCI Circuit Breakers: Single- and two-pole configurations.

    a. 5-mA trip sensitivity for personnel protection.
    b. 30-mA trip sensitivity for equipment protection.

C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical style suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
4. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
5. Shunt Trip: Where indicated, 120-V trip coil energized from separate circuit.

2.4 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Comply with mounting and anchoring requirements specified in Section 260548 "Seismic Controls for Electrical System."

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 260553 "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section 260553 "Electrical Identification."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch type and labeling verification.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in manufacturer's installation instructions for switches and molded-case circuit breakers. Certify compliance with test parameters.
2. Test mounting and anchorage devices according to requirements in Section 260548 “Seismic Controls for Electrical Systems.”
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 262816

SECTION 264113 - LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes lightning protection system for ordinary structures.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layouts of the lightning protection system, with details of the components to be used in the installation.
2. Include raceway locations needed for the installation of conductors.
3. Details of air terminals, ground rods, ground rings, conductor supports, splices, and terminations, including concealment requirements.
4. Include roof attachment details, coordinated with roof installation.
5. Calculations required by NFPA 780 for bonding of metal bodies.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of roof adhesive for attaching the roof-mounted air terminal assemblies, approved by the roofing-material manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For lightning protection system to include in maintenance manuals.

1. Include the following:

a. Dimensioned site plan showing dimensioned route of the ground loop conductor and the ground rod locations.
b. A system testing and inspection record, listing the results of inspections and ground resistance tests, as recommended by NFPA 780, Annex D.

B. Completion Certificate:

1. UL Master Label Certificate update.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: UL-listed installer, category OWAY.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. UL Lightning Protection Standard: Comply with UL 96A requirements for Class I buildings.

B. Lightning Protection Components, Devices, and Accessories: Listed and labeled by a qualified testing agency as complying with UL 96, and marked for intended location and application.

2.2 MATERIALS

A. Air Terminals:

1. Aluminum unless otherwise indicated.
2. 1/2-inch diameter by 12 inches long.

B. Class 1 Main Conductors:

1. Aluminum: 98,600 circular mils in diameter.

C. Secondary Conductors:

1. Aluminum: 41,400 circular mils in diameter.

D. Ground Loop Conductor: Tinned copper**.**

E. Ground Rods:

1. Material: Copper-clad steel.
2. Diameter: 3/4 inch (19 mm).
3. Rods shall be not less than 120 inches (3050 mm) long.

F. Conductor Splices and Connectors: Compression fittings that are installed with hydraulically operated tools, or exothermic welds, approved for use with the class type.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install lightning protection components and systems according to UL 96A.

B. Install conductors with direct paths from air terminals to ground connections. Avoid bends less than 90 degrees and 8 inches (203 mm) in radius and narrow loops.

C. Conceal conductors within normal view from exterior locations at grade within 200 feet (60 m) of building. Comply with requirements for concealed installations in UL 96A.

1. Roof penetrations required for down conductors and connections to structural-steel framework shall be made using listed through-roof fitting and connector assemblies with solid rods and appropriate roof flashings. Use materials approved by the roofing manufacturer for the purpose. Conform to the methods and materials required at roofing penetrations of the lightning protection components to ensure compatibility with the roofing specifications and warranty.
2. Install conduit where necessary to comply with conductor concealment requirements.
3. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's written instructions.

D. Ground Ring Electrode: The conductor shall be not less than the main-size lightning conductor.

3.2 CONNECTIONS

A. Aboveground concealed connections, and connections in earth or concrete, shall be done by exothermic welds or by high-compression fittings listed for the purpose.

B. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3.3 CORROSION PROTECTION

A. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture unless moisture is permanently excluded from junction of such materials.

B. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Perform inspections as required to obtain a UL Master Label update for system.

B. Prepare test and inspection reports and certificates.

END OF SECTION 264113

SECTION 264313 - SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes UL 1449 Type 2 surge protective devices for low-voltage power.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.

B. Product Certificates: Signed by manufacturers of surge protective devices, certifying that products furnished comply with the following testing and labeling requirements:

1. UL 1283 certification.
2. UL 1449 listing and classification.

C. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Failed test results and corrective action taken to achieve requirements.

D. Maintenance Data: For surge protection devices to include in maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size and dimensional requirements.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. IEEE Compliance: Comply with:

1. IEEE C62.41.1, "Guide on the Surge Environment in Low-Voltage (1000V and less) AC Power Circuits".
2. IEEE C62.41.2, "Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits".
3. IEEE C62.45, "Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits".

4. IEEE C62.72, "Guide for the Application of Surge Protective Devices for Low-Voltage (1000V and less) AC Power Circuits".
5. IEEE C62.45, "Standard Test Specifications for Surge Protective Devices for Low-Voltage (1000V and less) AC Power Circuits".

E. NEC Compliance: Comply with NEC 285, “Surge Protective Devices”.

F. UL Compliance: Comply with:

1. UL 96A, "Installation Requirements for Lightning Protection Systems": Where UL Master Label Certification is required for a lightning protection system.
2. UL 1283, "Electromagnetic Interference Filters".
3. UL 1449, "Transient Voltage Surge Suppressors": latest edition.

1.5 PROJECT CONDITIONS

A. Placing into Service: Do not energize or connect service entrance equipment and panelboards to their sources until the surge protective devices are installed and connected.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect/Engineer/Owner not less than two weeks in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner's written permission.

1.6 COORDINATION

A. Verify voltage rating of system to be protected by surge protective device.

B. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

1.7 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Final Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Current Technology, Inc.
2. ASCO.
3. Thor Systems, Inc.

2.2 PANELBOARD SUPPRESSORS

A. Manufacturer Series:

1. Current Technology #CGP Series.
2. ASCO #440 Series.
3. Thor Systems #TSni Series.

B. Include the following features and accessories:

1. LED indicator lights for power and protection status.
2. Surge Rating: 50kA per mode.
3. ANSI / UL 1449 VPR:

a. 120/208V: 800V maximum (L-N, L-G, N-G), 1200V maximum (L-L).
b. 277/480V: 1200V maximum (L-N, L-G, N-G), 2000V maximum (L-L).

4. Enclosures: NEMA 1.
5. Surge-event operations counter.

C. Connection Means: Permanently wired.

D. Protection modes:

1. Line to Neutral.
2. Line to Ground.
3. Neutral to Ground.

2.3 ENCLOSURES

A. NEMA 250, with type matching the enclosure of panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Install devices for panelboards with conductors between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

1. Provide multipole, 30-A circuit breaker as a dedicated disconnect for the suppressor, unless otherwise indicated.

3.2 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements.
2. Complete startup checks according to manufacturer's written instructions.

B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

END OF SECTION 264313

SECTION 265119 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes LED luminaires, materials, finishes, supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting contactors.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries, chargers, photometric performance data.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

1.5 INFORMATIONAL SUBMITTALS

A. Sample warranty.

B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.9 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five years from date of Final Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires and lamps shall withstand the effects of earthquake motions and be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

A. Standards:

1. Design Lights Consortium (DLC) qualified products list or ENERGY STAR certified.
2. UL 1598, Standard for Luminaires.
3. Recessed luminaires shall comply with NEMA LE 4.
4. UL Listing: Listed for damp or wet location as applicable.

B. CRI minimum of 80 CCT at 4000 K.

C. Rated lamp life of 50,000 hours minimum to L70.

D. Lamps dimmable from 100 percent to 0 percent of maximum light output.

E. Internal driver.

2.3 EMERGENCY LIGHTING UNITS

A. General: Self-contained units complying with UL 924.

1. LED lamp heads.
2. Battery: Sealed, maintenance-free, nickel-cadmium or nickel metal hydride type with minimum 10-year nominal life and special warranty. Battery sized to provide emergency illumination for not less than 90 minutes.
3. Charger: Fully automatic, solid-state type with sealed transfer relay.
4. Operation: Relay automatically turns lamp on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
5. Integral Time-Delay Relay: Holds unit on for fixed interval when power is restored after an outage; time delay permits high-intensity-discharge lamps to restrike and develop adequate output.

2.4 EXIT SIGNS

A. General: Comply with UL 924; for sign colors and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: Light-emitting diodes, 70,000 hours minimum of rated lamp life.

C. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

1. Battery: Sealed, maintenance-free, nickel-cadmium or nickel metal hydride type with special warranty. Battery sized to provide emergency illumination for not less than 90 minutes.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

2.5 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place. Label shall include the following lamp characteristics:

1. "USE ONLY" and include specific lamp type.
2. Lamp diameter, shape, size, wattage, and coating.
3. CCT and CRI for all luminaires.

2.6 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT

A. Comply with requirements in Section 260500 "Basic Electrical Materials and Methods" for channel and angle iron supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as luminaire.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

E. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls or a minimum 20-gauge backing plate attached to structure.

G. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing for suspension for each unit length of luminaire chassis, including one at each end.
4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

H. Ceiling-Grid-Mounted Luminaires:

1. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.
2. Fixtures of Sizes Less Than Ceiling Grid Pattern:

    a. Install as indicated on reflected ceiling plans or center in acoustical panel.
    b. Support fixtures independently with at least two 3/4-inch (metal channels spanning and secured to ceiling tees.
    c. Fixture is to be supported at two (2) opposite ends to the steel frame of the building using the same type of wire as used to support the lay-in ceiling track.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Operational Test: After installing luminaires, switches, and accessories; and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify normal transfer to battery power source and retransfer to normal. Perform a test on each unit after it is permanently installed and charged for a minimum of 24 hours. Battery shall be tested for 90 minutes. The battery test shall demonstrate compliance with the requirements of NEC 700.12(F). Repair and/or replace any units that fail the test, then retest.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Corroded Fixtures: During warranty period, replace fixtures that show any signs of corrosion.

END OF SECTION 265119

SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks and cabinets.
4. Telecommunications service entrance pathways.
5. Grounding.

B. Related Sections:

1. Section 271300 "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.
2. Section 271500 "Communications Horizontal Cabling" for voice and data cabling associated with system panels and devices.

C. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.

D. BICSI: Building Industry Consulting Service International.

E. Channel Cable Tray: A fabricated structure consisting of a one-piece, ventilated-bottom or solid-bottom channel not exceeding 6 inches (152 mm) in width.

F. Ladder Cable Tray: A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

G. LAN: Local area network.

H. RCDD: Registered Communications Distribution Designer.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Floor-mounted cabinets and cable pathways shall withstand the effects of earthquake motions determined according to ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets: Include workspace requirements and access for cable connections.
3. Grounding: Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings shall be under the direct supervision of RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

C. Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install equipment frames and cable trays until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and work above ceilings is complete.

1.7 COORDINATION

A. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.

1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.

B. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable tie slots fasten cable ties to brackets.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Support brackets with cable tie slots for fastening cable ties to brackets.
3. Lacing bars, spools, J-hooks, and D-rings.
4. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cable Management Solutions, Inc.
b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit.
e. GS Metals Corp.

2. Cable Tray Materials: Metal, suitable for indoors and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inch (0.012 mm) thick or hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inch (0.055 mm) thick.

a. Basket Cable Trays: Dimensions as indicated on the drawings, and 4" deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
b. Ladder Cable Trays: Nominal dimensions as indicated on the drawings, and a rung spacing of 9 inches (305 mm).

D. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes."

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Section 061053 "Miscellaneous Rough Carpentry."

2.3 EQUIPMENT FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. Aim Electronics; a brand of Emerson Electric Co.
3. AMP; a Tyco International Ltd. company.
4. Cooper B-Line, Inc.
5. Hubbell Premise Wiring.
6. KRONE Incorporated.
7. Leviton Voice & Data Division.

8. Middle Atlantic Products, Inc.
9. Nordex/CDT; a subsidiary of Cable Design Technologies.
10. Ortronics, Inc.
11. Panduit Corp.
12. Siemon Co. (The).

B. General Frame Requirements:

1. Distribution Frames: Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension: Width compatible with EIA 310 standard, 19-inch (480-mm) panel mounting.
3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Floor-Mounted Racks: Modular-type, steel or aluminum construction.

1. Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug, and a power strip.
2. Baked-polyester powder coat finish.

D. Modular Freestanding Cabinets:

1. Removable and lockable side panels.
2. Hinged and lockable front and rear doors.
3. Adjustable feet for leveling.
4. Screened ventilation openings in the roof and rear door.
5. Cable access provisions in the roof and base.
6. Grounding bus bar.
7. Power strip.
8. Baked-polyester powder coat finish.
9. All cabinets keyed alike.

E. Modular Wall Cabinets:

1. Wall mounting.
2. Steel or aluminum construction.
3. Treated to resist corrosion.
4. Lockable front and rear doors.
5. Louvered side panels.
6. Cable access provisions top and bottom.
7. Grounding lug.
8. Power strip.
9. All cabinets keyed alike.

F. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers.
2. Baked-polyester powder coat finish.
3. Vertical cable management panels shall have front and rear channels, with covers.
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

2.4 POWER STRIPS

A. Power Strips: Comply with UL 1363.

1. Rack mounting.
2. Six, 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles.

3. LED indicator lights for power and protection status.
4. LED indicator lights for reverse polarity and open outlet ground.
5. Circuit Breaker and Thermal Fusing: Unit continues to supply power if protection is lost.
6. Cord connected with 15-foot (4.5-m) line cord.
7. Rocker-type on-off switch, illuminated when in on position.
8. Peak Single-Impulse Surge Current Rating: 26 kA per phase.
9. Protection modes shall be line to neutral, line to ground, and neutral to ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.5 GROUNDING

A. Comply with requirements in Section "Grounding and Bonding for Electrical Systems." for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
2. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

2.6 LABELING

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Contact telecommunications service provider and arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.

B. Install underground pathways complying with recommendations in TIA/EIA-569-A, "Entrance Facilities" Article.

3.2 INSTALLATION

A. Install underground entrance pathway complying with Section 260533 "Raceway and Boxes."

B. Comply with NECA 1.

C. Comply with BICSI TDMM for layout and installation of communications equipment rooms.

D. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.

E. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.4 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements in Section 260553 "Electrical Identification." Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

B. See Section 271500 "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section.

C. Labels shall be preprinted or computer-printed type.

END OF SECTION 271100

SECTION 271300 - COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cable.
3. 62.5/125-micrometer, optical fiber cabling.
4. Coaxial cable.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Cabling identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. RCDD: Registered Communications Distribution Designer.

G. UTP: Unshielded twisted pair.

1.4 BACKBONE CABLING DESCRIPTION

A. Backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Backbone cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

1. For coaxial cable, include the following installation data for each type used:

a. Nominal OD.
b. Minimum bending radius.
c. Maximum pulling tension.

B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules.
2. Cabling administration drawings and printouts.
3. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
4. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:

a. Vertical and horizontal offsets and transitions.
b. Clearances for access above and to side of cable trays.
c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

C. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

D. Source quality-control reports.

E. Field quality-control reports.

F. Maintenance Data: For splices and connectors to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.

2. Test optical fiber cable while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector, including the loss value of each. Retain test data and include the record in maintenance data.
3. Test each pair of UTP cable for open and short circuits.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 COORDINATION

A. Coordinate layout and installation of telecommunications pathways and cabling with Owner's telecommunications and LAN equipment and service suppliers.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Patch-Panel Units: One of each type.
2. Connecting Blocks: One of each type.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Cable Trays:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cable Management Solutions, Inc.
b. Cablofil Inc.
c. Cooper B-Line, Inc.
d. Cope - Tyco/Allied Tube & Conduit.
e. GS Metals Corp.

2. Cable Tray Material: Metal, suitable for indoors, and protected against corrosion by electroplated zinc galvanizing, complying with ASTM B 633, Type 1, not less than 0.000472 inches (0.012 mm) thick or hot-dip galvanizing, complying with ASTM A 123/A 123M, Grade 0.55, not less than 0.002165 inches (0.055 mm) thick.

a. Basket Cable Trays: Dimensions as indicated on the drawings, and 4" deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).

b. Ladder Cable Trays: Nominal dimensions as indicated on the drawings, and a rung spacing of 9 inches (305 mm).

D. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes."

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm).

2.3 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Molex Premise Networks; a division of Molex, Inc.
9. Nordex/CDT; a subsidiary of Cable Design Technologies.
10. Superior Essex Inc.
11. SYSTIMAX Solutions; a CommScope Inc. brand.
12. 3M.
13. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, 25-pair UTP, with a gray thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, General Purpose: Type CM or CMG.
b. Communications, Plenum Rated: Type CMP complying with NFPA 262.
c. Communications, Riser Rated: Type CMR, complying with UL 1666.
d. Communications, Limited Purpose: Type CMX.
e. Multipurpose: Type MP or MPG.
f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.

7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

D. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair UTP cable, plus spares and blank positions adequate to suit specified expansion criteria.

E. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

F. Patch Cords: Factory-made, 4-pair cables in 48-inch (1200-mm) lengths; terminated with 8-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.5 OPTICAL FIBER CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Berk-Tek; a Nexans company.
2. CommScope, Inc.
3. Corning Cable Systems.
4. General Cable Technologies Corporation.
5. Mohawk; a division of Belden CDT.
6. Nordex/CDT; a subsidiary of Cable Design Technologies.
7. Optical Connectivity Solutions Division; Emerson Network Power.
8. Superior Essex Inc.
9. SYSTIMAX Solutions; a CommScope Inc. brand.
10. 3M.
11. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: Multimode, 62.5/125-micrometer, 24-fiber, nonconductive, tight buffer, optical fiber cable.

1. Indoor Cable: Comply with ICEA S-83-596 for mechanical properties.
2. Outside Plant Cable: Comply with ICEA S-87-640 for mechanical properties.
3. Comply with TIA/EIA-568-B.3 for performance specifications.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

a. General Purpose, Nonconductive: Type OFN or OFNG.
b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
c. Riser Rated, Nonconductive: Type OFNR, complying with UL 1666.
d. General Purpose, Conductive: Type OFC or OFCG.
e. Plenum Rated, Conductive: Type OFCP, complying with NFPA 262.

f. Riser Rated, Conductive: Type OFCR, complying with UL 1666.

5. Conductive cable shall be steel armored type.
6. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

C. Jacket:

1. Jacket Color: Orange for 62.5/125-micrometer cable.
2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm).

2.6 OPTICAL FIBER CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ADC.
2. American Technology Systems Industries, Inc.
3. Berk-Tek; a Nexans company.
4. Corning Cable Systems.
5. Dynacom Corporation.
6. Hubbell Premise Wiring.
7. Molex Premise Networks; a division of Molex, Inc.
8. Nordex/CDT; a subsidiary of Cable Design Technologies.
9. Optical Connectivity Solutions Division; Emerson Network Power.
10. Siemon Co. (The).

B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.

1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

C. Patch Cords: Factory-made, dual-fiber cables in 36-inch (900-mm) lengths.

D. Cable Connecting Hardware:

1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA/EIA-604-2, TIA/EIA-604-3-A, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
2. Quick-connect, simplex and duplex, connectors. Match existing. Insertion loss not more than 0.75 dB.
3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.7 COAXIAL CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Alpha Wire Company.
2. Belden CDT Inc.; Electronics Division.
3. Coleman Cable, Inc.
4. CommScope, Inc.
5. Draka USA.

B. General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

C. RG-11/U: NFPA 70, Type CATV.

1. No. 14 AWG, solid, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
4. Jacketed with sunlight-resistant, black PVC or PE.
5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

D. RG59/U: NFPA 70, Type CATVR.

1. No. 20 AWG, solid, silver-plated, copper-covered steel conductor.
2. Gas-injected, foam-PE insulation.
3. Triple shielded with 100 percent aluminum polyester tape and 95 percent aluminum braid; covered by aluminum foil with grounding strip.
4. Color-coded PVC jacket.

E. RG-6/U: NFPA 70, Type CATV or CM.

1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
3. Jacketed with black PVC or PE.
4. Suitable for indoor installations.

F. RG59/U: NFPA 70, Type CATV.

1. No. 20 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
2. Double shielded with 100 percent aluminum polyester tape and 40 percent aluminum braid.
3. PVC jacket.

G. RG59/U (Plenum Rated): NFPA 70, Type CMP.

1. No. 20 AWG, solid, copper-covered steel conductor; foam fluorinated ethylene propylene insulation.
2. Double shielded with 100 percent aluminum-foil shield and 65 percent aluminum braid.
3. Copolymer jacket.

H. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV.
2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.8 COAXIAL CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aim Electronics; a brand of Emerson Electric Co.
2. Leviton Voice & Data Division.
3. Siemon Co. (The).

B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.9 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding" for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.10 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

2.11 SOURCE QUALITY CONTROL

A. Factory test cables on reels according to TIA/EIA-568-B.1.

B. Factory test UTP cables according to TIA/EIA-568-B.2.

C. Factory test multimode optical fiber cables according to TIA/EIA-526-14-A and TIA/EIA-568-B.3.

D. Cable will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays.

1. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes."

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A.

B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Section 271100 "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

D. Comply with requirements in Section 260533 "Raceway and Boxes" for installation of conduits and wireways.

E. Install manufactured conduit sweeps and long-radius elbows whenever possible.

F. Pathway Installation in Communications Equipment Rooms:

1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 6 inches (152 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
5. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
6. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
10. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
11. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

F. Outdoor Coaxial Cable Installation:

1. Install outdoor connections in enclosures complying with NEMA 250, Type 4X. Install corrosion-resistant connectors with properly designed O-rings to keep out moisture.

G. Group connecting hardware for cables into separate logical fields.

H. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping." Comply with TIA/EIA-569-A, Annex A, "Firestopping."

B. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

B. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

C. See Section 271500 "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about TIA/EIA standard as it applies to this Section.

D. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

F. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    a. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA 606-A, for the following:

1. Cables use flexible vinyl or polyester that flexes as cables are bent.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

3. Optical Fiber Cable Tests:

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

b. Link End-to-End Attenuation Tests:

1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.

2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

E. End-to-end cabling will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 271300

SECTION 271500 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. UTP cabling.
2. Telecommunications outlet/connectors.
3. Cabling system identification products.

1.3 DEFINITIONS

A. BICSI: Building Industry Consulting Service International.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. EMI: Electromagnetic interference.

D. IDC: Insulation displacement connector.

E. LAN: Local area network.

F. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

G. RCDD: Registered Communications Distribution Designer.

H. UTP: Unshielded twisted pair.

1.4 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector. Where allowed, transition points or consolidation points will be indicated on the drawings.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

B. The maximum allowable horizontal cable length is 295 feet (90 m). This maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) to the workstation equipment. The

maximum allowable length does not include an allowance for the length of 16 feet (4.9 m) in the horizontal cross-connect.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility: Preparation of field testing program development by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.

D. Grounding: Comply with ANSI-J-STD-607-A.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Test cables upon receipt at Project site.

1. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

A. General Requirements: Comply with TIA/EIA-569-A.

B. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.

1. Support brackets with cable tie slots for fastening cable ties to brackets.
2. Lacing bars, spools, J-hooks, and D-rings.
3. Straps and other devices.

C. Conduit and Boxes: Comply with requirements in Section 260533 "Raceway and Boxes."

2.2 UTP CABLE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Belden CDT Inc.; Electronics Division.
2. Berk-Tek; a Nexans company.
3. CommScope, Inc.
4. Draka USA.
5. Genesis Cable Products; Honeywell International, Inc.
6. KRONE Incorporated.
7. Mohawk; a division of Belden CDT.
8. Molex Premise Networks; a division of Molex, Inc.
9. Nordex/CDT; a subsidiary of Cable Design Technologies.
10. Superior Essex Inc.
11. SYSTIMAX Solutions; a CommScope, Inc. brand.
12. 3M.
13. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.

1. Comply with ICEA S-90-661 for mechanical properties.
2. Comply with TIA/EIA-568-B.1 for performance specifications.
3. Comply with TIA/EIA-568-B.2, Category 6.
4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

a. Communications, General Purpose: Type CM or CMG.
b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
c. Communications, Riser Rated: Type CMR, complying with UL 1666.
d. Communications, Limited Purpose: Type CMX.
e. Multipurpose: Type MP or MPG.
f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.3 UTP CABLE HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Technology Systems Industries, Inc.
2. Dynacom Corporation.
3. Hubbell Premise Wiring.
4. KRONE Incorporated.
5. Leviton Voice & Data Division.
6. Molex Premise Networks; a division of Molex, Inc.
7. Nordex/CDT; a subsidiary of Cable Design Technologies.
8. Panduit Corp.
9. Siemon Co. (The).
10. Tyco Electronics/AMP Netconnect; Tyco International Ltd.

B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

C. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.

1. Number of Jacks per Field: One for each four-pair conductor group of cables, plus spares and blank positions adequate to suit specified expansion criteria.

D. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.

E. Patch Cords: Factory-made, four-pair cables in 48-inch (1200-mm) lengths; terminated with eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.4 TELECOMMUNICATIONS OUTLET/CONNECTORS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets:

1. Two-port-connector assemblies mounted in single faceplate.
2. Metal Faceplate: Stainless steel, complying with requirements in Section 262726 "Wiring Devices."
3. Legend: Machine printed, in the field, using adhesive-tape label.

2.5 GROUNDING

A. Comply with requirements in Section 260526 "Grounding and Bonding " for grounding conductors and connectors.

B. Comply with ANSI-J-STD-607-A.

2.6 IDENTIFICATION PRODUCTS

A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

B. Comply with requirements in Section 260553 " Electrical Identification."

2.7 SOURCE QUALITY CONTROL

A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.

B. Factory test UTP cables according to TIA/EIA-568-B.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces and attics, where unenclosed wiring method may be used. Conceal raceway except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes."

B. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.

B. Comply with requirements in Section 260533 "Raceway and Boxes" for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
7. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
8. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
9. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
10. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
    c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
3. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
4. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.4 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with ANSI-J-STD-607-A.

3.6 IDENTIFICATION

A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A.

B. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

C. Cable and Wire Identification:

1. Label each cable within 4 inches (100 mm) of each termination, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 30 feet (9 m).
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
    a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
    b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

D. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

5. UTP Performance Tests:

a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:

1) Wire map.
2) Length (physical vs. electrical, and length requirements).
3) Insertion loss.
4) Near-end crosstalk (NEXT) loss.
5) Power sum near-end crosstalk (PSNEXT) loss.
6) Equal-level far-end crosstalk (ELFEXT).
7) Power sum equal-level far-end crosstalk (PSELFEXT).
8) Return loss.
9) Propagation delay.
10) Delay skew.

C. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 271500

SECTION 275116 - PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Loudspeakers.
2. Conductors and cables.
3. Pathways.

1.3 DEFINITIONS

A. Channels: Separate parallel signal paths, from sources to loudspeakers or loudspeaker zones, with separate amplification and switching that permit selection between paths for speaker alternative program signals.

B. VU: Volume unit.

C. Zone: Separate group of loudspeakers and associated supply wiring that may be arranged for selective switching between different channels.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Power, signal, and control wiring.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, required clearances, method of field assembly, components, and location and size of each field connection.
3. Console layouts.
4. Control panels.
5. Rack arrangements.
6. Calculations: For sizing backup battery.
7. Wiring Diagrams: For power, signal, and control wiring.
    a. Identify terminals to facilitate installation, operation, and maintenance.
    b. Single-line diagram showing interconnection of components.
    c. Cabling diagram showing cable routing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. An existing MOOD / Muzak Encompass LE Audio System is located in room Building Management A11 on the first (ramp) level.

B. All new devices shall be compatible with the existing system.

C. MOOD / Muzak contact:

1. Tim Cogdill
2. 919-457-7443
3. Tim.cogdill@moodmedia.com

D. Comply with NFPA 70.

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

A. System Functions:

1. Selectively connect any zone to any available signal channel.
2. Selectively control sound from microphone outlets and other inputs.
3. "All-call" feature shall connect the all-call sound signal simultaneously to all zones regardless of zone or channel switch settings.
4. Telephone paging adapter shall allow paging by dialing an extension from any local telephone instrument and speaking into the telephone.
5. Produce a program-signal tone that is amplified and sounded over all speakers, overriding signals currently being distributed.
6. Reproduce high-quality sound that is free of noise and distortion at all loudspeakers at all times during equipment operation including standby mode with inputs off; output free of nonuniform coverage of amplified sound.

2.3 SYSTEM DESCRIPTION

A. Compatibility of Components: Coordinate component features to form an integrated system. Match components and interconnections for optimum performance of specified functions.

2.4 AMPLIFIERS / MIXERS

A. Design Basis: TOA BG-2120.

2.5 VOLUME CONTROLLERS

A. Design Basis: Lowell Custom 100LVC.

B. Surface mounted.

C. Wall plate: Stainless steel.

2.6 SPEAKERS

A. Design Basis: MOOD XDA521T / DMX CM1525R.

B. Flush mounted.

C. White.

2.7 CONDUCTORS AND CABLES

A. Jacketed, twisted pair and twisted multipair, untinned solid copper.

1. Insulation for Wire in Conduit: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
2. Plenum Cable: Listed and labeled for plenum installation, where installed in plenum spaces.

2.8 PATHWAYS

A. Conduit and Boxes: Comply with Section Raceway and Boxes.

1. Outlet boxes shall be not less than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters, and except in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal pathway and cables except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for pathways and boxes specified in Section Raceway and Boxes.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.2 INSTALLATION OF PATHWAYS

A. Comply with requirements in Section Raceways and Boxes for installation of conduits and wireways.

B. Install manufactured conduit sweeps and long-radius elbows whenever possible.

3.3 INSTALLATION OF CABLES

A. Comply with NECA 1.

B. General Cable Installation Requirements:

1. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at outlets and terminals.
2. Splices, Taps, and Terminations: Arrange on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Cables may not be spliced.
3. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
4. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
5. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
6. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used.

C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend speaker cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceiling by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.

D. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Install in separate pathways or, where exposed or in same enclosure, separate conductors at least 12 inches (300 mm) apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other communication equipment conductors as recommended by equipment manufacturer.

3.4 INSTALLATION

A. Coordinate layout and installation of system components and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

C. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so they identify media in coordination with system wiring diagrams.

D. Conductor Sizing: Unless otherwise indicated, size speaker circuit conductors from racks to loudspeaker outlets not smaller than No. 18 AWG.

E. Connect wiring according to Section Communications Horizontal Cabling.

3.5 GROUNDING

A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Schedule tests with at least seven days' advance notice of test performance.
2. After installing public address system and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: Perform tests that include originating program and page messages at microphone outlets, preamplifier program inputs, and other inputs. Verify proper routing and volume levels and that system is free of noise and distortion.

D. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified. Prepare a list of final tap settings of paging speaker-line matching transformers.

E. Public address system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

1. Include a record of final speaker-line matching transformer-tap settings and signal ground-resistance measurement certified by Installer.

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
2. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the public address system and equipment.

END OF SECTION 275116

SECTION 281500 - ACCESS CONTROL SYSTEM AND SECURITY MONITORING

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Card readers.
2. Biometric identity-verification equipment.
3. Cables.
4. Transformers.
5. Security monitoring for fire doors.

B. Related Sections include the following:

1. Section 344739 "Baggage Conveying Equipment."

C. Access control is also to be configured for new baggage handling system control panels. Work will require coordination with the baggage handling system vendor for planning and installation.

D. Security monitoring of fire door positions of baggage handling conveyors is to be configured by interfacing with dry contacts at the baggage handling conveyor motor control panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, details, and attachments to other work.

1. Wiring Diagrams. For power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For security system to include in emergency, operation, and maintenance manuals.

1. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on USB media of the hard-copy submittal.
2. System installation and setup guides with data forms to plan and record options and setup decisions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

1. The existing access control and security systems are maintained by Johnson Controls. All work for additions to the systems shall be coordinated with Johnson Controls.

a. Contact: David Rockwell, 910-794-4326, David.T.Rockwell@jci.com.

B. Source Limitations: Identifier readers shall be compatible with the existing access control system that is in place.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F, and not more than 80 percent relative humidity, noncondensing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70, "National Electrical Code."

2.2 CARD READERS / BIOMETRIC READERS

A. Compatible with existing access control system and matching existing card readers installed.

2.3 BIOMETRIC IDENTITY-VERIFICATION EQUIPMENT

A. Fingerprint Analysis Scanner: Compatible with existing access control system and matching existing card readers installed.

2.4 CABLES

A. General Cable Requirements: Comply with requirements and as recommended by system manufacturer for integration requirement.

2.5 TRANSFORMERS

A. NFPA 70, Class II control transformers, NRTL listed. Transformers for security access-control system shall not be shared with any other system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for card readers to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."

B. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.

3.3 CABLE APPLICATION

A. Card Readers and Biometric Readers:

1. Install number of conductor pairs recommended by manufacturer for the functions required.

3.4 GROUNDING

A. Comply with IEEE 1100, "Recommended Practice for Power and Grounding Electronic Equipment."

B. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

C. Bond shields and drain conductors to ground at only one point in each circuit.

3.5 INSTALLATION

A. Install card readers / biometric readers.

B. Install cabling for access control readers.

C. Install cabling for fire door position monitoring.

3.6 IDENTIFICATION

A. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.
2. Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

3.7 SYSTEM SOFTWARE AND HARDWARE

A. Modify and test software for the reader additions. Test new hardware. Perform database tests for the complete and proper operation of new readers installed.

B. Modify and test software for fire doors position monitoring.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to perform testing.

B. Tests and Inspections:

1. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.

C. Devices and circuits will be considered defective if they do not pass tests and inspections.

END OF SECTION 281500

SECTION 282300 - VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.0 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.1 SUMMARY

A. Section includes:

1. Video surveillance cameras.
2. Cabling.

B. Related Sections include the following:

1. Section 260500 "Basic Electrical Materials and Methods."
2. Section 260533 "Raceways and Boxes."
3. Section 271500 "Communications Horizontal Cabling."

1.2 QUALITY ASSURANCE

A. Qualification Data for Contractor:

1. Licensed as a Burglar Alarm Business with an Alarm Systems Business License by the North Carolina Alarm Systems Licensing Board.
2. A letter from the manufacturer of all major equipment stating that the manufacturer's representative is an authorized distributor. This letter shall also state the manufacturer guarantees service performance for the life of the equipment, and that there will always be an authorized distributor assigned to service the area in which the system has been installed.

B. Qualification Data for Installer:

1. Holds a North Carolina Electrical Contractors License in one of the following categories: Unlimited, Limited, Intermediate or SP-Low Voltage.
2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. The existing video surveillance system is maintained by Johnson Controls. All work for additions to the systems shall be performed by or coordinated with Johnson Controls.
    a. Contact: David Rockwell, 910-794-4326, David.T.Rockwell@jci.com .

C. Source Limitations: Surveillance cameras shall be compatible with the existing surveillance system that is in place.

1.3 WORK INCLUDED

A. The contractor shall furnish all equipment, accessories, and material required for the installation of video surveillance cameras in strict compliance with these specifications and applicable contract drawings. Any material and/or equipment necessary for the proper operation of the system, which is not specified or described herein, shall be deemed part of this specification.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. The specific item proposed and its area of application shall be marked on the catalog cuts.

1.5 SUBSTITUTIONS

A. Any system and/or equipment proposed as an equal to that specified must be proven to conform to the standards contained herein. The contractor must obtain the architect's or engineer's approval in writing, prior to bidding equipment other than that specified no later than ten (15) days prior to the Bid Date. The manufacturer's name, model numbers, and three (3) copies of shop/working drawings complete with catalog sheets, technical and installation data shall be submitted for approval.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of cameras, equipment related to camera operation, and control-station equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Avigilon.

B. Pre-approved equivalents.

2.2 CAMERAS

A. Provide IP cameras based on application and as indicated in the project drawings.

1. Interior 360 degree dome cameras with pan-tilt-zoom functionality.
2. Interior fixed focus cameras.
3. Exterior 360 degree dome cameras with pan-tilt-zoom functionality, progressive scan, day night feature. Exterior or Interior locations that require a wall mount shall use a PWM484S bracket.
4. Exterior fixed focus cameras.
5. All cameras shall be provided with memory cards installed and configured to allow for back up recording in the event of a network failure and the card shall buffer the events back to the recorder when network is reestablished.
6. Mounting brackets configured or specific installation locations and configurations.

2.3 CABLE

A. Cat 6 network cables for cameras shall be installed by Division 27 contractor. Video surveillance contractor shall supply all patch cables for cameras.

PART 3 - EXECUTION

3.1 DIVISION OF WORK

A. While all work included under this specification is the complete responsibility of the contractor, the anticipated division of work follows:

1. The conduit, boxes, supports, etc., which form part of the rough-in work shall be furnished and installed by the electrical contractor.
2. Cat 6 cables shall be furnished and installed by the data/communications contractor.
3. Cameras, mounting brackets, PoE switches, patch cables, startup, testing, and demonstration furnished and installed by the video surveillance contractor.

3.2 INSTALLATION

A. Install cables in raceways unless otherwise indicated.

B. Install cameras and infrared illuminators level and plumb.

C. Set pan unit and pan-and-tilt unit stops to suit final camera position and to obtain the field of view required for camera. Connect all controls and alarms, and adjust.

D. Cable Identification: All wires shall be permanently identified at each wire end utilizing a self-laminated wire or cable marker comprised of a white label with black lettering and clear laminate area, in a manner approved by the Owner.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Inspection: Verify that units and controls are properly installed, connected, and labeled, and that interconnecting wires and terminals are identified.
2. Pretesting: Align and adjust system and pretest components, wiring, and functions to verify that they comply with specified requirements. Conduct tests at varying lighting levels, including day and night scenes as applicable. Prepare video-surveillance equipment for acceptance and operational testing as follows:
    a. Verify operation of auto-iris lenses.
    b. Set back-focus of fixed focal length lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Adjust until image is in focus with and without the filter.
    c. Set back-focus of zoom lenses. At focus set to infinity, simulate nighttime lighting conditions by using a dark glass filter of a density that produces a clear image. Additionally, set zoom to full wide angle and aim camera at an object 50 to 75 feet away. Adjust until image is in focus from full wide angle to full telephoto, with the filter in place.
    d. Set and name all preset positions; coordinate with Owner's personnel.
    e. Verify operation of control-station equipment.

3. Operational Tests: Test equipment for proper operation in all functional modes.

E. Video surveillance system will be considered defective if it does not pass tests and inspections.

3.4 DEMONSTRATION

A. Demonstrate camera functionality to Owner personnel.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Tasks shall include, but are not limited to, the following:

1. Check cable connections.
2. Check proper operation of cameras and lenses. Verify operation of auto-iris lenses and adjust back-focus as needed.
3. Adjust all preset positions; consult Owner's personnel.
4. Recommend changes to cameras, lenses, and associated equipment to improve Owner's use of video surveillance system.
5. Provide a written report of adjustments and recommendations.

3.6 CLEANING

A. Clean installed items using methods and materials recommended in writing by manufacturer.

B. Clean video-surveillance-system components, including camera-housing windows and lenses.

END OF SECTION 282300

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1.2 SYSTEM DESCRIPTION

A. Microprocessor controlled, intelligent reporting fire detection and alarm system.

1.3 SUMMARY

A. Section Includes:

1. Manual fire-alarm boxes.
2. System smoke detectors.
3. Heat detectors.
4. Notification appliances.
5. Addressable interface device.
6. Power supplies.

B. Related Sections:

1. Section 344739 "Baggage Conveying Equipment."

1.4 DEFINITIONS

A. AHJ: Authority Having Jurisdiction.

B. LED: Light-emitting diode.

C. NICET: National Institute for Certification in Engineering Technologies.

1.5 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the North Carolina State Building Code.

B. Comply with applicable provisions of NFPA 70, National Electrical Code.

C. Comply with applicable provisions of NFPA 72, National Fire Alarm Code.

D. Equipment supplied shall be specifically listed for its intended use and shall be installed in accordance with the manufacturer's instructions.

E. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 QUALITY ASSURANCE

A. Designer for Preparation of Shop Drawings and Calculations Qualifications:

1. Personnel shall be trained and certified by manufacturer for system design required for this Project.
2. Personnel shall be certified by NICET as fire-alarm Level III (minimum) technician.

B. Installer Qualifications:

1. Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
2. Supervisor of installation shall be certified by NICET as fire-alarm Level II (minimum) technician.
3. Supervisor of installation shall be certified as an authorized representative of the equipment manufacturer.
4. Minimum of 5 years of experience installing fire detection and alarm systems similar in size and scope to this project.

C. Manufacturer's Field Service Technician Qualifications:

1. Personnel shall be trained and certified by manufacturer for installation of units specifically required for this Project within the most recent 24 months.
2. Personnel shall be certified by NICET as fire-alarm Level II (minimum) technician.
3. If not trained by the manufacturer within 24 months (as noted in 1 above), but within 36 months, NICET fire alarm Level III (minimum) technician certification is required.

D. Source Limitations for Fire-Alarm System and Components:

1. For facilities with existing functional systems in place, new components shall be compatible and listed for use with, and operate as, an extension of existing system.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 SUBMITTALS

A. Qualification Data:

1. Designer:

a. Manufacturer training certification.
b. NICET certification.

2. Installer:

a. Manufacturer training certification.
b. NICET certification.
c. Authorized representative of equipment manufacturer certification.
d. Experience documentation; 5 years of similar size & scope projects.

3. Manufacturer Field Service Technician:

a. Manufacturer training certification.
b. NICET certification.

B. Product Data:

1. Manufacturer data for each type of product, equipment, device, etc. proposed.

2. For devices, include milliamp (mA) draw and listed minimum voltage required to operate each type of device.

C. Shop Drawings: For fire-alarm system to demonstrate compliance with project drawings and specifications. Include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Provide floor plans with:
    a. Final equipment and device locations, including address of each addressable device and notification appliance.
    b. Wiring diagrams with proposed conduit routing and conductors/cables in each conduit section.
    c. Distances for NAC circuitry sections.
3. Provide voltage drop calculations for notification appliance circuits. Voltage drop at EOL device shall not exceed 14% of the battery voltage. Worst case voltage at each notification appliance shall be no less than the minimum listed operating voltage.
4. Provide battery calculations.

D. Seismic Qualification Certificates: For fire-alarm accessories and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Field quality-control reports.

F. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. System Status and Programming Report.
4. Record copy of site-specific software on CD and USB flash drive (thumb drive).
5. As-built documents.
    a. Provide duplicates of the shop drawing plans, wiring diagrams, and riser diagrams showing comprehensive and clear field revisions. Include loop numbers, device addresses, terminal numbers where connected to equipment, and wire color codes.
    b. Provide a drawing with submitted battery and voltage drop calculations. Include a field for entering actual metered values during system testing.
6. Technical literature for all control equipment, devices, isolation modules, relays, power supplies, alarm/supervisory signal initiating devices, etc. Include maintenance data and parts lists. Include circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
7. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.

d. Manufacturer's user training manuals.

8. Manufacturer's required maintenance related to system warranty requirements.

1.8 PROJECT CONDITIONS

A. An existing Notifier Fire Alarm Control Panel is in place and functional.

1. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed. Report deficiencies to the Owner and Architect.
2. All new devices shall be compatible with the existing system.
3. The Owner's fire alarm system maintenance and service vendor is:

Sentinel Security
Contact: Al Brunjes, 910-395-6141, awbrunjes@sentinelsysstems.us

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities unless permitted under the following conditions and then only after arranging to provide 24-hour fire watch personnel:

1. Notify Architect/Engineer/Owner no fewer than two weeks in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

1.9 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational throughout the project work. As new equipment is installed, temporarily label it "NOT IN SERVICE" until it is accepted. Remove temporary labels from new equipment when put into service.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.10 WARRANTY

A. Provide parts and labor warranty of one year from the date of final inspection and/or acceptance by the Owner.

PART 2 - PRODUCTS

2.1 SYSTEMS OPERATIONAL DESCRIPTION

A. For work associated with this project, fire-alarm signal shall initiate the following actions:

1. Activate dry contacts to serve as inputs to baggage handling system control panels. Normally closed relay contacts shall open upon fire alarm conditions.

B. Circuits: All circuits shall have a pathway survivability of LEVEL 1.

1. Notification Appliance Circuits (NAC):

a. NFPA 72 Class B.
b. End of line (EOL) resistors shall be installed for FACU supervision of circuit integrity. Locate EOL resistors as follows:

1) Where accessible to fire alarm system maintenance personnel.

2) Where maintenance or testing at the EOL resistor location will not be disruptive to the normal use of the facility.
3) Where not easily accessible to the normal building occupants.
4) Where no higher than 9' AFF or lower than 7' AFF.
5) Not in stairwells or restrooms.

c. NAC circuits shall not exceed 75% of maximum load current allowed.

2. New Signaling Line Circuits (SLC): NFPA 72 Class A, no "T" taps, and a minimum of 20% spare addresses.
3. Initiating Device Circuits (IDC): NFPA 72 Class A.
4. Digital electronic signals shall utilize check digits or multiple polling to prevent a single ground or open on any NAC, SLC, or IDC from causing system malfunction, loss of operating power, or the ability to report an alarm.
5. Isolation Modules:

a. Isolation modules shall automatically isolate wire-to-wire shorts on an SLC circuit.
b. Install isolation modules at the following locations:

1) In or adjacent to the FACU at each end of addressable loops.
2) After each 20 initiating devices and control points on an addressable loop.
3) For addressable loops with less than 20 devices and control points, install isolators at the middle of the loop in addition to those at the FACU.
4) At the point where an addressable loop extends outside of the building.
5) In terminal cabinets on each floor where addressable loops cover more than one floor level.

c. Isolation modules shall be readily accessible, not located above ceilings, and clearly labeled. Record drawings shall indicate isolator module locations.
d. Provide an LED that flashes to indicate the isolation module is operational and that burns steady to indicate that a short circuit condition has been detected and isolated.

6. Wiring Methods:

a. Generally, all fire alarm circuitry shall be in 3/4" minimum metal conduit. Where fishing circuitry is required above existing gypgoard ceiling spaces, metal clad listed fire alarm cable is acceptable. Junction boxes and covers not in finished areas shall be painted red.
b. SLC addressable loop circuits shall be wired with type FPL/FLLR/FPLP fire alarm cable, 18 AWG minimum, low capacitance, copper, twisted pair. Cable jacket shall have a red jacket with red and black conductor insulation. For underground circuits, use type TC or PLTC cable (PE insulated).
c. All other circuits shall be wired with 14 AWG minimum, stranded copper, type THHN/THWN conductors.

C. Voice/Alarm Signaling Service:

1. One-way Emergency Voice-Alarm (PA Type) System.

a. Must be compatible with existing Notifier fire alarm panel.
b. One new amplifier is required as part of this project scope.

2. One-way Voice/Alarm digital audio circuits are to be wired with twisted pair copper conductors. (AWG 18 minimum) in jacketed cable, or with fiber optic cable. Analog audio circuits are to be wired with AWG 18 minimum twisted pair copper conductors in shielded cable, Belden 8790, West Penn 293, or equal. For shielded cables, the shield must be continuously connected from the amplifiers to the end of line. Tape the shield splice at each speaker and handset, to insulate from ground. Single point ground the shield at the amplifier or control unit unless prohibited by the system manufacturer.

3. Voice/Alarm Emergency Power

a. Batteries:

1) Gel-cell, sealed, plate nickel cadmium, maintenance free.
2) Minimum of 24 hours standby capacity plus 15 minutes of voice evacuation full alarm load.

2.2 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes:

1. Comply with UL 38.
2. Dual-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
3. Positive, visual indication of operation.
4. Station Test and Reset: Key-operated switch.
5. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
6. Pull Station Cover with Horn:

a. Clear, tamperproof, polycarbonate cover hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
b. Listed for outdoor use for outdoor pull stations.
c. Flush mount cover for recessed boxes. Surface mount cover with conduit spacer for applications requiring surface mounted conduit.

2.3 SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall typically be two-wire type for connection to an SLC. Four-wire type detectors may be required if connecting to an existing four-wire system.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
4. Integral Visual-Indicating Lights: Provide both alarm and power LEDs, flashing under normal conditions. LEDs shall burn steady, controlled by the FACU, to indicate an alarm condition.
5. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring. Provide terminals in the fixed base for connection of a remote alarm LED.
6. Self-Restoring: Detectors shall not require resetting or readjustment after actuation to restore them to normal operation.
7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
8. Test Means: Provide a means to simulate an alarm condition and report to the FACU. Test shall be initiated at the detector (activation of a magnetic switch) or initiated remotely on command from the FACU when in "test" condition.
9. Detectors shall store an identifying device type code for FACU identification of devices as either ION, PHOTO, or THERMAL.
10. Sounder Bases: Provide bases with integral sounder rated 85 dB minimum, measured at 10 feet.

B. Photoelectric Smoke Detectors:

1. Use photoelectric / light scattering principal to measure smoke density and send data to the FACU representing analog level of smoke density.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    a. Primary status.
    b. Device type.
    c. Present average value.
    d. Present sensitivity selected.
    e. Sensor range (normal, dirty, etc.).

2.4 HEAT DETECTORS

A. General Requirements for Heat Detectors:

1. Comply with UL 521.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
3. Integral Visual-Indicating Lights: Provide both alarm and power LEDs, flashing under normal conditions. LEDs shall burn steady, controlled by the FACU, to indicate an alarm condition.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring. Provide terminals in the fixed base for connection of a remote alarm LED.
5. Use electronic sensor to measure thermal conditions caused by fire and send data to the FACU representing analog level of such thermal conditions.

B. Heat Detector, Combination Type:

1. Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
2. Fixed-temperature sensing shall be independent of rate-of-rise sensing.
3. Mounting: Twist-lock base interchangeable with smoke-detector bases.
4. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 194 deg F.

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.

2.5 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections. Comply with requirements for both visual and audible notification appliances.

B. Visible Notification Appliances (Strobes):

1. Xenon strobe lights complying with UL 1971, 24-V dc nominal.
2. Rated Light Output: 15/30/75/110 cd, selectable in the field.
3. Flashing shall be in a temporal pattern, synchronized with other units. Maximum pulse duration: 0.2 seconds.

4. Clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" shall be engraved in minimum 1-inch high letters on the lens.
5. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
6. Strobe Leads: Factory connected to screw terminals.
7. Mounting Faceplate: Factory finished, color to match existing**.**

C. Voice/Tone Notification Appliances (Speakers):

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. Speakers shall operate at voltage to match existing**.** dc nominal.
    a. High-Range Units: Rated 2 to 15 Watt (W).
3. Low-Range Units: Rated 1 to 2 W.
    a. Include taps at 1/4 W, 1/2 W, 1W, and 2W.
4. Matching Transformers: Tap range matched to acoustical environment of speaker location.
5. Provide back boxes for all speakers.

2.6 ADDRESSABLE INTERFACE DEVICES

A. Monitor Modules:

1. For use in providing a system address for alarm-initiating devices for wired applications with normally open dry contacts.
2. Provide an LED that flashes under normal conditions, indicating that the monitor module is operational and in regular communication with the FACU.
3. Modules installed in non-conditioned spaces shall be tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed locations.

B. Control Modules:

1. For use in auxiliary control functions, operating as a dry contact relay.
2. Typical equipment control functions would include direct signals to: an elevator controller to initiate elevator recall, to a circuit-breaker shunt trip for power shutdown, or to a lighting control system for lighting control scenario under fire alarm conditions.
3. For use in supervising and controlling the operation of one NAC.
4. Provide an LED that flashes under normal conditions, indicating that the module is operational and in regular communication with the FACU.

2.7 AUXILIARY POWER SUPPLIES

A. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module.

1. Alarm current draw of entire supplied circuitry loads shall not exceed 80 percent of the power-supply module rating.
2. 120V branch breaker shall be physically protected with a handle lock and identified with a 1/4" diameter permanent red dot applied to the breaker handle or exposed body area.

B. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries:
    a. Gel-cell, sealed, plate nickel cadmium, maintenance free.
    b. Minimum of 24 hours standby capacity plus:
        1) 15 minutes of voice evacuation full alarm load.

c. Add battery capacity for a 25% safety factor.

2. Charger: Dual-rate charging techniques for fast battery recharge.
3. Battery cabinet enclosures shall be twice the size of the batteries contained.

C. Auxiliary power supplies shall be individually monitored by the FACU and protected by a smoke detector.

D. Coordinate installation location with the Owner and Engineer. Do not install above ceilings or in non-conditioned spaces.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment and Device Mounting:

1. Install equipment and devices securely attached to walls, ceilings, floors, building structure. Hardware and supports shall be suitable for the load supported. Ceiling mounted devices shall not be supported solely by suspended ceilings.
2. Comply with requirements for seismic-restraint devices specified in Section 260548 "Seismic Controls for Electrical Systems."

C. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.

1. Expand, modify, and supplement existing circuitry as necessary to extend existing control and/or monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

D. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
4. When installed in a room, orient so that the alarm LED is visible from the nearest door to the corridor.

E. Detector Protection:

1. Unless suitably protected from dust, paint, etc.; detectors shall not be installed until final construction clean-up is complete. If contaminated, detectors shall be replaced.
2. Where accidental damage or deliberate abuse is anticipated, provide a protective guard that is listed for use with the detector and is acceptable to the AHJ.

F. Audible Alarm-Indicating Devices: Unless ceiling mounted, install not less than 6 inches below the ceiling. Install horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

G. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn; and unless ceiling mounted, install at least 6 inches below the ceiling.

H. Device Location-Indicating Lights: Locate in public space near the device they monitor.

I. Make addressable connections with a supervised interface device to the devices and systems as indicated on the drawings. Install the interface device less than 3 feet from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals.

B. Detectors, appliances, and modules shall be labeled with unique numbers that are indicated on as-built drawings and permanently mounted on device bases. Labels shall be legible from floor level. Labels shall be printed black lettering on clear background and attached to the device base.

C. Junction and pull box covers shall be labeled to indicate the circuits or function of the conductors contained in the boxes. Labels shall be neatly applied with black lettering on clear background.

D. Conductors shall be labeled with permanent wire markers at connections at the FACU, other control equipment, power supplies, and terminal cabinets.

E. NFPA 72 Record of Completion documentation shall be kept inside the FACU, or its kept location shall be permanently indicated inside the FACU on an engraved label.

F. At all equipment with a 120 VAC power source, provide an engraved label indicating panelboard ID, branch circuit number, and panelboard location. At the FACU, provide an additional engraved label inside the FACU.

3.3 FIELD QUALITY CONTROL

A. Final field tests shall be witnessed by authorities having jurisdiction.

B. Manufacturer's Field Service: Engage a factory-authorized service technician to make connections to the FACU; to program the system; to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

C. Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.
    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
    b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
2. Conductor Testing: All conductors shall be tested for grounds, opens and shorts prior to termination at panels and installation of detector heads. Conductors shall be megger tested for a minimum of 10 megohms from conductor to ground and conductor to conductor. Provide record of test results to Engineer in advance of acceptance inspection.
3. Test mounting and anchorage devices according to requirements in Section 260548 "Seismic Controls for Electrical Work."
4. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion", NFPA 72, Figure 1-6.2.1 in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72. Submit "Fire Alarm System Record of Completion" to Engineer for delivery to Owner.
6. For AHJ acceptance inspection, perform sampling testing as directed by AHJ for detectors and functional tests. Provide 2-way radios, ladders, smoke source, and other materials needed for testing the system.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 283111

SECTION 313116 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes soil treatment for termite control.

1.3 ACTION SUBMITTALS

A. Product Data: Treatments and application instructions, including EPA-Registered Label.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements of the N.C. Dept. of Agriculture, Structural Pest Control Division.

B. Bill of materials (proof of quantity of material purchased), estimate of square footage of coverage (area of treated ground) and certification that mix and rates of application comply with governing restrictions and manufacturers recommendations. Quantities will be verified.

C. Qualification Data: For applicator.

D. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's record information, including the following as applicable:

1. Date and time of application.
2. Moisture content of soil before application.
3. Brand name and manufacturer of termiticide.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes, and rates of application used.
6. Areas of application.
7. Water source for application.

E. Sample Warranties: For special warranties.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: A Pest Control Operator who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance.

B. Regulatory Requirements: Formulate and apply termiticides, and label with a Federal registration number, to comply with EPA regulations and authorities having jurisdiction.

C. Standards for Application: Current edition of North Carolina Administrative Code 2:34.0506 and North Carolina Structural Pest Control Committee Rules and Regulations.

D. Source Limitations: Obtain termite control products from single manufacturer for each product.

E. Testing: If required by the Architects Construction Administrator or Owner, the Contractor shall contact the NC Department of Agriculture to have treated soil tested to verify application compliance. Allow a minimum of 2 days notice to schedule inspection.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with EPA-Registered Label requirements and requirements of authorities having jurisdiction.

1.7 COORDINATION

A. Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

1.8 WARRANTY

A. Special Warranty: Written warranty, signed by applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

A. Continuing Service: Provide a proposal for continuing service, including monitoring, inspection, and retreatment for occurrences of termite activity, from applicator to Owner, in the form of a standard yearly (or other period) continuing service agreement, starting on the date of Substantial Completion. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Manufacturers: Subject to compliance with requirements of the N.C. Dept. of Agriculture, Structural Pest Control Division, provide products by one of the following:

1. AgrEvo Environmental Health, Inc.
2. Bayer Corp.
3. Dow AgroSciences.
4. FMC Corp.
5. Zeneca Ag Products.

B. Termiticide: Provide an EPA-registered termiticide, complying with requirements of state and local authorities having jurisdiction, in a soluble or emulsible concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Provide quantity required for application

at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label.

1. Use only soil treatment solutions that are not harmful to plants.
2. Use compatible dye in termiticide to provide visible evidence of treatment.
3. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer.

C. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly.

1. Slabs-on-Grade: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
3. Masonry: Treat voids.

4. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified independent testing agency to perform field quality-control testing and provide report to Architect.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer receiving termiticide treatment. Proceed with subsequent work only after inspections for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not been adequately treated with termiticide, reapply treatment and retest until specified treatment has been achieved.

3.6 PROTECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

B. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION 313116

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General

1. Drawings, Divisions 00, 01 and 02 of the Contract Documents, and general provisions of the Contract, including General and Supplementary Conditions apply to the Work of this Section.
2. These written Specifications, in conjunction with the accompanying BHS Contract Drawings and below referenced project related documents (reference Section 1.1.C), constitute the Contract Documents for the Project. If there are any discrepancies between these written Specifications, the BHS Contract Drawings and the project related documents in section 1.1.C, the more stringent requirement shall apply as interpreted by the Owner or their Representative.
3. This BHS project is intended to provide the specified new Ticket Counter Conveyor Lines with associated outbound transport, checked baggage screening load/unload conveyor belts, and baggage make-up, as well as preserve the right-of-ways for an upcoming future Mini In-Line Checked Baggage Inspection System (CBIS) that is planned to ultimately automate the checked baggage screening process for the Terminal Renovation and Expansion Program. Implement and demonstrate to the Owner or their representative the installed BHS in compliance with all associated Performance and Commissioning requirements, as specified herein.
4. These Contract Documents are confidential and are not to be distributed or copied, in part or in whole, without the written consent of an authorized representative of the Owner or BNP Associates, Inc.

B. Drawings

1. The Baggage Handling System Specification, Drawings (Ref. Drawing B-000 for listing), Architectural Drawings, Communications/Network Layout Drawings, Fire Protection System Drawings, MEP (Mechanical, Electrical and Plumbing) Drawings, Structural Drawings, Addendum, Contract Provisions, Special Provisions and Supplementary Provisions apply to the work of this Section.
2. It shall be the BHS Contractor's responsibility to request and obtain architectural drawings, MEP (Mechanical, Electrical and Plumbing) drawings, Structural drawings and other applicable plans required for BHS coordination from the Owner or their Representative.

C. Existing Equipment Drawings.

1. Information regarding existing conveyor equipment designated for removal, such as but not limited to Mechanical/Electrical as-built documents/information, O&M Manuals, and layout drawings/documents, PLC software and source codes along with other relative documentation relating to the existing BHS, shall be obtained from Owner or their Representative.
2. The BHS scope for this project affects the Bagroom and Arrivals/Ticketing Levels of the Terminal, as illustrated in the accompanying BHS Drawing Package. Additionally, the scope includes the necessary connections of the proposed new BHS with the specified PC-type Computer Terminal Workstation, which shall be located at the Airport Safety Office.
3. Contact the Owner or their Representative and request the necessary documents, existing software and source codes that would be required for the work. The Owner makes no guarantees regarding the accuracy or completeness of the existing documentation, so take on the responsibility to verify all information that is gathered from the Owner or their Representative.
4. If As-built documentation is not available, engage the necessary staff to obtain the needed information on the existing systems and equipment via site survey. Ensure that all project documentation for this work is presented as complete and comprehensive as possible during the detail design and shop drawing submittal phase; generate any/all pertinent information or documentation that is not available from Owner's records.

D. Project Related Documents

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. Division 00 – Procurement and Contracting Requirements
2. Division 01 – General Requirements
3. Division 26 – Electrical Requirements
4. Division 27 – Communications
5. Division 28 – Electrical Safety and Security
6. Contact the appropriate firm or supplier through the Owner or their Representative to request the necessary documents that would be required for the necessary coordination, testing, interface and reference purposes.

1.2 SUMMARY

A. General

1. Section 347739 of the Project Specifications is divided into four (4) parts as follows:
    a. Part 1 of this section specifies general administrative, procedural and performance requirements for the Baggage Handling System portion of this project, including the removal, temporary reinforcement and/or rerouting of BHS conduits, control stations, and related BHS field devices to satisfy the specified phased-in implementation requirements, and installation of new conveyor equipment with required system integration between the provided BHS components and the facility systems such as the Fire Alarm and Access Control Systems, as specified herein and in the accompanying drawings.
    b. Part 2 specifies product information including acceptable BHS Manufacturers and Integrators, BHS Equipment suppliers, materials to be used on this project along with control system design and approved equipment requirements.
    c. Part 3 specifies execution requirements for the BHS installation and alterations to the existing BHS that are required and shall be provided for this project.
    d. Part 4 specifies the minimum Quality Control that shall be maintained and performed by the BHS Contractor for this project, including required system acceptance inspections and testing.
2. The BHS Specification (347739) and accompanying BHS Contract Drawings, which are associated with this Scope of Work, are performance-based documents that are intended to outline the overall scope of work, define functional requirements and establish minimum standards of quality for the Project. Review and verify the proposed BHS layout with existing site conditions and provide the overall design intent as summarized within these contract documents. Additionally, provide the engineering, programming, and fabrication of all baggage handling conveyor equipment (with related maintenance access zones), transportation to/from the site, power, and control panels with associated distribution control system design requirements, maintenance/fault diagnostics, installation, testing and turning over in working order the modified BHS in compliance with the project documents. Comply with all local, state and federal laws, codes and safety standards and assure a safe and efficient system for all personnel who operate, maintain or have access to the completed baggage handling system.
3. The laws of the City of Wilmington, New Hanover County, the State of North Carolina, and the United States of America (USA) shall apply and govern the Contract.
4. The term Owner used throughout this document shall mean the New Hanover County Airport Authority.
5. Unless otherwise specified, all references to sums of money shall be in United States Dollars (USD), the currency of the United States of America (USA).

B. Scope of Work

1. Provide the design, engineering, fabrication, transportation to/from the site, installation, temporary BHS conditions (e.g., interim conveyor equipment and associated control functionality, as required to maintain operations), removal, salvage, demolition, modifications, testing and turning over in working order the outbound BHS described herein, in compliance with these written Specifications and the accompanying BHS Drawings.
2. Provide a complete, operable, maintainable and safe system on a "turnkey basis", including all

Copyright © 2018 by BNP Associates, Inc. (BNP)

permanent supports, header steel (unless otherwise specified), hangers, anchors, framing, trim, electrical power to all BHS related equipment/components from the sources indicated on the accompanying Contract Drawing Package (i.e., from the BHS MCPs and onto all associated 480VAC and 120VAC BHS field components), motors, motor starters, PLCs, MCPs and associated Fault Monitoring Touchscreen Terminals, the BHS PC-type Computer Terminal Workstation, switches / routers / firewalls, printers, disconnects, controls for all specified field components, pushbuttons, conduit, wiring, fire/security doors, cabinets, impact protection for the Make-Up Unit, and Oversize Make-up Slide, including catwalks, ladders, crossovers (including Control Stop/Start control stations / stack lights as applicable at all BHS area crossovers), pavement markings/striping, non-powered portable roller conveyors with flip up sections associated to the EDS machines, and all other necessary BHS components/devices, whether specifically shown and described, or implied in the plans and specifications or wherever required to effectively accomplish the intended functions of the outbound BHS. In all cases where a device or part of the equipment is herein referred to in the singular number, it is intended that such reference shall apply to as many such devices as are required to satisfactorily complete the installation.

3. Provide all hardware, software and construction supervision to ensure that there is a complete, total and fully functioning interface between the outbound BHS with associated PLCs, the Building Access Control System, Fire Alarm System, PLCs, the MCP Touchscreen Terminal, the BHS PC-type Computer Terminal Workstation and all other components of the Outbound Baggage system, so that the entire system operates on a fully integrated "turnkey" basis.
4. Provide all labor, materials, and equipment required to implement the new outbound BHS, which shall include but not limited to the following:

    a. Demolition/removal, including all required materials, and conveyor equipment with all related components. Take on the responsibility to inform the Owner or their Representative that equipment designated for removal has been removed and are available for review to determine what shall be salvaged for spare parts considerations and what shall be disposed.
    b. Installation of all required conveyor segments and fire/security doors, New Baggage Make-Up device, catwalk with all associated access ladders, stairs, and crossovers, as illustrated in the accompanying drawings.
    c. Temporary reinforcement and interim conveyor segments with associated conduits, control stations and related field devices, as needed to accommodate the phased implementation of the BHS.
    d. All required demonstrations for the Owner's acceptance inspections/testing.
    e. All necessary conduit and wiring between BHS equipment/components. All related field wiring, components and controls stations, including internal MCP wiring for the specified installations relating to new conveyor equipment, shall be numbered consistent with the specified numbering scheme of the conveyor segments they are associated with.
    f. Necessary protection of conveyor equipment that is under construction.
    g. Provision of MCP Touchscreen Terminals.
    h. Provision a BHS PC-type Computer Terminal Workstation, including coordination, design and modification to existing Airport Network interface between the BHS in the Terminal and the PC Type Workstation, which shall be located at the Airport Safety Office which is shown on Civil Drawing C-401. Coordinate for Communications / Network closets / rooms located near the BHS equipment in the Terminal (Building Management Room # A11) and the Airport Safety Office, to include appropriate switch and port assignments with the Owner.
    i. BHS PLCs, PLC Networks, and other applicable components/devices.

5. Submit implementation schedules and associated phasing plan documentation, with the operating and maintenance documentation to the Owner or their representative, including required manuals, equipment parts lists and shop drawings - all in strict accordance with the specifications and applicable drawings, and subject to the terms and conditions of the Contract.
6. Develop detailed Phasing Plans for each subsystem consistent with the specified requirements and after discussions/coordination with the Owner or their representative to determine/confirm the availability of the respective Baggage Handling System Area or affected subsystem(s).
7. The Contract Drawings are intended to generally outline the conveyor system configuration and function desired. Pertinent building dimensions are noted along with some specified conveyor dimensions and elevations. Conveyor length and right-of-ways are presented as approximations, but

Copyright © 2018 by BNP Associates, Inc. (BNP)

these shall necessarily be determined by review and inspection of building construction drawings (As-Builts) and verified by actual field measurements. Field measure actual conditions and dimensions, prior to preparing shop and erection drawings. Additionally, the number, size and locations of BHS Motor Control Panels (MCPs) are presented as approximations. Verify the final number of panels with related cabinet sizes and locations based on the preparation of applicable engineering/electrical shop drawings and submit the system MCP sizes and related power requirements in accordance with the schedule of submissions..

8. Coordinate the outbound BHS with the MEP drawings (e.g., ductwork, sprinkler system, facility electrical and plumbing right-of-ways) and architectural detail drawings to fully coordinate the BHS installation with all the other systems that will be modified or installed in the same area of the facility spaces. This coordination process shall also include the responsibility to coordinate the BHS conveyor right-of-ways, related conduit/wireway runs, and maintenance catwalk design with other systems, including the sprinkler system design, to permit the installation of the sprinkler pipes below the catwalks or areas where they are projecting below adjacent conveyors. The coordination between the design of other systems and the BHS equipment (conveyor segments, related conduits/wireways and catwalks) shall ensure other systems do not interfere with the BHS operation or related maintenance access and baggage flow right-of-ways. Sprinkler system lines or other MEP equipment shall not be supported off the BHS equipment or its supporting structure (i.e., BHS overhead or floor supports). The coordination shall ensure the required interface between the BHS equipment and the adjoining architectural building elements.
9. Preserve all future conveyor right-of-ways and all BHS mechanical and electrical equipment right of ways for all deferred equipment that are depicted on the Contract Drawings.
10. Identify all building interface requirements necessary to install the outbound BHS over and above those shown on the contract drawings during the detail design and shop drawing submittal period. Verify as-built building conditions and notify the Owner or their representative of conflicts.
11. The construction of all the new equipment and components of the system(s) shall be in accordance with all codes and standards and local laws and regulations, applicable to the design and construction of this type of equipment, which are generally accepted and used as good practice throughout the industry, i.e., NFPA, Underwriters Laboratories, OSHA, SAE publications, National Electrical Code (NEC), American National Standards and all pertinent standards and codes of the USA, the state of North Carolina and of the New Hanover County Airport Authority. Design all parts and sub-assemblies in accordance with good commercial practice and assure safe, efficient and practical design in keeping with requirements peculiar to this type of system. All equipment shall be in imperial dimensions.
12. Submit to the Owner or their Representative any request for information, clarification of specification, and variance from the specifications as a Request For Information (RFI), in compliance with Division 01, section 013100 (Project Management And Coordination).
13. Submit all electrical drawings, structural attachment details, with associated computations and point load drawings, signed and sealed by a Professional Engineer licensed in the State of North Carolina.
14. Engage the services of Professional Engineer(s) licensed in the State of North Carolina, in the relevant disciplines, to review and certify the installation of the BHS equipment structural support system and associated attachments to the building structure, which shall include all necessary temporary and final works.
15. Prior to the implementation of each phase of the Project, submit all BHS Phasing Plans, electrical design and control diagrams to Owner or their Representative for review and approval.
16. Cooperate and coordinate with the Owner or their Representative for the location of all Mechanical, Plumbing, Electrical, Right-of-Ways and access/egress between the BHS catwalks and the building to confirm the final number and locations of the BHS associated stairs, ladders, conveyor maintenance crossovers and maintenance catwalks.
17. Cooperate with the Owner or their Representative and other on-site contractors for coordination of the building fire zones to confirm the number and location of the BHS associated fire/security doors and their interface requirements to the BHS PLCs, the MCP Touchscreen Terminals and PC-type Computer Terminal Workstation.
18. The limits of the existing building structural capacity to support new BHS loads are indicated in the Contract Documents. The BHS Contractor is responsible to determine BHS loads, analyze the BHS load distribution and impacts to the existing building structure, and provide the necessary support systems within the existing building to distribute or re-distribute the imposed BHS loads so they do

Copyright © 2018 by BNP Associates, Inc. (BNP)

not exceed the existing building structural capacity limits indicated in the Contract Documents. If the BHS Contractor's structural analysis determines the existing building structure requires reinforcing to support the new BHS, the BHS Contractor is responsible to reinforce the existing structure.

19. Provide all conveyor equipment, components and support structures for the BHS including, but not limited to, columns, beams and header steel and take on the responsibility to coordinate the proposed BHS support system with the Owner, the overall project implementation schedules, and airline's operational schedules. All conveyor equipment supports shall be designed, engineered and installed so as not to infringe on the airport and airline operational areas, drive aisles and cart staging areas. Coordinate with all necessary Contractor disciplines on site and with the Owner, the overall Project Implementation Schedule, the facility layout, drive aisles, cart staging lanes and Airline's operational schedules to avoid any conflicts.
20. Coordinate and adequately protect the conveyor equipment from the Mechanical, Electrical and Plumbing (MEP) modifications, as well as other related building service modifications and alterations. Ensure that adequate protection is provided around the conveyor segments wherever the Facility and Utility modifications are occurring. Ensure that the construction around the conveyors and the protection that shall be provided around the conveyor segments allows for the uninterrupted and continued operation of the baggage handling systems in all cases.
21. Upon completion of the BHS installation, all related programming and internal testing/debugging, demonstrate the system's operating capability to the Owner for acceptance to confirm compliance with the specified requirements. Provide all labor and test material as specified elsewhere in this document, including service technicians and test material handlers for the BHS Acceptance Testing. These test demonstrations shall be carried out per the BHS Test Plans that shall be prepared by the BHS Contractor in compliance with the specified requirements of Part 4, Section 4.2 (Inspection/Testing and Acceptance).

C. BHS General Requirements

1. The Outbound Baggage Handling System (BHS) that is specified to be installed is illustrated on the accompanying Drawing Package (for reference, refer to the Contract Documents for a complete listing of drawings).
2. The following briefly describes the proposed implementation of the Outbound System for the Terminal Renovations and Expansion Program at Wilmington International Airport.
3. As set forth elsewhere in these specifications, provide the definitive architecture for the BHS, with associated MCPs, Touchscreen Terminals, PC-type Computer Terminal Workstation and PLC systems that are specified to be provided. Provide a detailed BHS design and any/all coordination required for the associated control system in its entirety, including related BHS interface requirements to the Fire Alarm and Access Control Systems, which shall be submitted to the Owner for review and approval.
4. Provide one (1) BHS PC-type Computer Terminal Workstation for the outbound BHS operation and all required PLC hardware/programming to satisfy the specified requirements for the installation of the BHS (e.g., memory capacity, the necessary interlocks/interfaces, to incorporate each sequence of the phased-in scope of work).
5. Outbound BHS

    a. The BHS shall be configured so that the TC2 outbound transport conveyor line merges onto the TC1 main outbound transport so that both Ticket Counter lines feed onto a single runout conveyor that shall be located within the TSA's Security Screening Area, where bags will be manually loaded into the existing relocated EDS machines for screening. A separate load conveyor shall also be provided, immediately south of the EDS machines, for the transport of TSA cleared bags from the screening area to the baggage make-up device. Oversize baggage will be manually transported from the Departures Level to the TSA Oversize baggage screening area for baggage screening and subsequent input of cleared baggage onto the oversize slide. All cleared status bags shall be processed to the make-up device (MU1) via the Clear Bag Subsystem (OT1).
    b. Furnish and Install (1) New Slope Plate Make-Up Device and all related components as described in the specifications.

Copyright © 2018 by BNP Associates, Inc. (BNP)

D. New Outbound BHS Requirements

1. Provision of all conveyors, MCPs with associated Fault Monitoring Touchscreen Terminal, PLCs, fire/security doors and Computer equipment with related field components to facilitate the outbound Baggage Handling System.
2. Coordinate and assist the TSA's EDS Contractor and rigger with the placement of the EDS machines. Coordination and assistance regarding the actual placement of the EDS machines (interim and final) with associated roller beds, and workstations shall include, but not be limited to, the markings and exact location (e.g., centerline markings) of the EDS machine as it relates to its respective conveyor line to assist with the rigging and installation of the EDS machines.
3. Fire/Security Doors and Interface

    a. Provide, install and integrate all BHS fire/security doors, consistent with the specified requirements of Part 2 and the details that are illustrated in the accompanying drawing package.
    b. The Fire Alarm Contractor will be responsible for wiring and conduit to the BHS MCPs to the required connection points within the Fire Alarm panels, which will be provided under Section 283111 (Fire Alarm). Provide relays and terminal blocks to support the interface from the Fire Alarm System to the BHS.

4. BHS Draft Curtains

    a. Provide and install draft curtains at all locations where conveyor lines pass through wall and floor openings and at the Oversize slide, consistent with the specified requirements of Part 2 and the details that are illustrated in the accompanying drawing package.

5. Maintenance Catwalks

    a. Provide and install all BHS related maintenance catwalks, and ladders, stairs and crossovers, consistent with the specified requirements of Part 2 and the details that are illustrated in the accompanying drawing package.

6. Security Card Reader Interface

    a. Provide the interface and coordinate with the Owner or their Representative the integration of all Building Access Control System security card readers with the BHS operation (i.e., TC1 and TC2 start/stop controls functionality). New security card readers will be located at all ticket counter subsystems, and the BHS shall incorporate these readers into the startup procedure. The Building Access Control System Contractor will be responsible for wiring and conduit to / from the BHS MCPs to the required connection points within the security card reader panels, which will be provided under Section 281300 (Access Control). Provide relays and terminal blocks to support the interface from the Building Access Control System to the BHS and provide relays or relay output modules to support the interface from the BHS to the Building Access Control System.

E. Existing Baggage Handling System (BHS) Designated for Removal/Disposal

1. As part of the BHS implementation, the existing conveyor segments that are designated to be removed during course of the project shall adhere to, but are not limited to, the specified requirements of Part 3.

F. Motor Control Panels and Programmable Logic Controllers (MCP/PLCs)

1. Provide MCPs and PLCs for the Outbound BHS, as required, to accommodate the specified functions. The complete Outbound BHS shall be controlled by PLCs with "Cold Back-Up" redundancy as specified elsewhere in this document.
2. Provide all related power and control wiring with associated conduits from the BHS related Motor Control Panels and onto their subsystem conveyor segment(s) field equipment/components, per the subsystem breakdown that is defined in the contract documents.
3. Coordinate the installation locations for the MCPs with the encased architectural cross bracing between columns and with the housekeeping concrete pads as shown on the Structural drawings.

Copyright © 2018 by BNP Associates, Inc. (BNP)

G. Baggage Handling System PC-Type Computer Terminal Workstation

1. One (1) Baggage Handling PC-Type Computer Terminal Workstation shall be provided, at the Airport Safety Office to monitor the Outbound BHS . The PC-type computer terminal workstation shall act as the interface between the PLCs, and any other external computer/control system that requires interface to the BHS (e.g., Building Access Control System, and Fire Alarm System) and shall include user interface terminals, and a Maintenance Diagnostics System with associated reporting functionality, which shall serve three (3) primary functions, as follows:

   a. Data base processing.
   b. Monitoring of the system status.
   c. Statistical information storage.

2. Provide the installation, integration and necessary implementation to the BHS PC-type Computer Terminal Workstation, as applicable. The PC Type Workstation shall accurately reflect the completed outbound system layout and be complete in design and installation with all fault and reporting capabilities. The PC-type Computer Terminal Workstation shall monitor, report, and display the system's status (graphic and text based) identically to the MCP touch screen terminals in a real-time mode.

H. BHS Interface Requirements

1. The Baggage Handling PLCs shall interface directly with the following Terminal building systems:

   a. The Building Access Control System for the start/stop conveyor functionality of the TC1 and TC2 conveyor subsystems and associated Fire/Security Doors, via their respective Airport Card-Swipe Module that will be provided under Section 281300 (Access Control).
   b. The Fire Alarm System for the controlled operation of the Fire/Security Doors under a fire alarm signal.

I. BHS Allowances

1. Provide a line item cost for spare parts for the Owner's review and consideration to include to the project scope.

   a. In the base scope provide a $100,000 allowance for the purchase of spare parts from the estimated spare parts list that shall be submitted to the Owner or their representative (with unit cost) as part of the submittal requirements.

J. BHS Bid Alternate

1. Provide a line item cost for the following item/work for the Owner's review and consideration to include/replace in the project scope.

   a. In lieu of the base scope requirement to provide BHS Maintenance Catwalk (with sheet steel) plus Associated Ships Ladders, Swing-down Aluminum Ladders, Vertical Fixed Ladders, and Cross-overs, provide the price to provide BHS Maintenance Catwalk (with open steel grating), & Associated Ships Ladders, Swing-down Aluminum Ladders, Vertical Fixed Ladders, & Cross-overs.

K. Project Phased Implementation Schedule

1. The Project Construction (Phasing) Schedule appears in the contract documents. It shows the phases and dates for this project. Adhere to the project construction (Phasing) schedule that appears in the contract documents and comply with all applicable requirements of Division 01, Section 011000 (Summary). Strict attention shall be made to the phases and dates for this project. The Owner or their Representative shall coordinate project phasing and may on occasion change the phase work. Therefore, the project schedule may be updated during the course of the project. Fulfill duties in accordance with the latest project schedule, at no additional cost to the Owner. Take on the responsibility in whole for the on-time completion of the total Baggage Handling System, specified herein.
2. The installation of the new conveyor equipment and removal of the existing equipment shall occur

Copyright © 2018 by BNP Associates, Inc. (BNP)

simultaneously with ongoing airline operations. The Baggage Handling System installation and modifications shall be completed in phases as coordinated with the program overall phased implementation requirements.

3. The BHS Scope of Work shall be scheduled and coordinated (installation, and removal and interim connections), with airline flight schedules and hours of operation, so as not to impact the Airport's normal functions. For reference purposes, third-shift work period may be considered between the hours of 8:00pm and 4:00am. However, all of the BHS work shall be performed as coordinated with the local TSA, and the Owner`s bagroom operation. Coordinate, through the or their Representative, the work windows within the departures and apron level operational areas to establish the times during the day and/or night for each phase, which will also be dependent on the work to be performed so as to allow the BHS Contractor to take down portions of the system for the respective phase. The BHS implementation, within the terminal operational areas, shall be performed per the specified Phases. Within each phase, the BHS Contractor shall have an average of an eight (8) hour work window, to perform his work, as coordinated with the local TSA, the Owner`s bagroom operation. The Owner or their Representative will have the right to allocate separate areas of the departures and apron level operational areas, on a daily basis (if necessary), to allow the BHS Contractor to break-up his work window within the coordinated work space(s) that satisfy the allowable work window without compromising the bagroom operation. Transfer all of the necessary installation material, conveyor components, and tools required for the modifications to and from the designated Lay-Down areas during the work period. Installation material, equipment and tools/components shall not be permitted within the operational areas. Ensure all alteration areas are broom clean after completion of the work prior to turning that area over to the Owner for the commencement of airline operations.
4. Comply with the overall program Phased Implementation Plans, which are included with the accompanied drawing package and the Project-Phasing descriptions that are referenced in the contract documents for the overall installation.
5. Prepare an outline and schedule with associated drawings for review and approval by the Owner or their Representative illustrating the coordinated baggage handling system Phased Implementation, prior to commencing with the installation of the baggage handling system.
6. Include as part of the proposal the best duration period per BHS phase and staffing levels required to complete the specified work. Provide the staffing resources necessary to acceptably complete each BHS activities of the Phased Implementation Program according to the Contract Schedule.
7. Each BHS phase shall be fully tested and accepted prior to proceeding to the next phase, as applicable for the respective subsystem(s) that need to come on line for beneficial use.

L. Interim BHS Conditions Manual Handling of Baggage

1. The project phasing will include interim airline and TSA operational conditions, as illustrated in the phasing documents, which shall need to be adhered to, so as to minimize the conveyor line`s downtime and inconvenience to the airlines/operators. In this regard, provide manual labor for assistance to the airlines and TSA, to manually handle bags during the interim conditions, while the conveyor equipment is out of service.
2. During the phased-in implementation, provide staffing/labor for certain operational conditions, as a fallback condition when the conveyor subsystem is out of service for the specified alterations and/or should a tie-in be delayed, or a failure is experienced that will inhibit the airline`s continued operation.
3. Coordinate with the Owner or their Representative the scheduling of this activity and provide a separate line item cost as part of the BID submittal.
4. As part of the functional controls submittal, submit the description of operation for the interim BHS conveyor subsystem connections. The controls descriptions for the interim BHS conditions shall also indicate the respective conveyor line`s interim operational condition and related manual handling fallback provisions per the above referenced requirements.

1.3 DEFINITIONS

A. Acronyms and Abbreviations

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. AA shall mean American Airlines
2. ACS shall mean Access Control System
3. Airport shall mean Wilmington International Airport or (ILM)
4. ANS shall mean American National Standards
5. ANSI shall mean American National Standards Institute
6. ASCII shall mean American Standard Code for Information Interchange
7. AOA shall mean Airport Operations Area
8. ATO shall mean Airline Ticket Office
9. Architect shall mean The Wilson Group (TWG)
10. BHS shall mean Baggage Handling System
11. BNP shall mean BNP Associates, Inc., the Baggage Handling System Consultant/Engineer.
12. BMTT shall mean Bag Maximum Travel Time
13. BVS shall mean Baggage Viewing Stations, the EDS Machine's Level 2 on-screen resolution screening computer workstation at which TSOs view the images of the alarmed baggage content(s)
14. CEMA shall mean Conveyor Equipment Manufacturers Association
15. COF shall mean Coefficient of Friction
16. Cold Back-up shall mean that redundancy is based on the removal of a failed primary component (e.g. PLC) and subsequent replacement with a fully programmed component (PLC).
17. DL shall mean Delta Air Lines
18. EDS shall mean Explosive Detection System (Computed Tomography), a machine, such as the Reveal CT-80DR, which has been designated for installation or relocation by the TSA's OEM/Contractor for this project.
19. EIA shall mean Electronic Industry Association
20. EPROM shall mean Erasable Programmable Read Only Memory
21. ETD shall mean Explosive Trace Detection
22. FAA shall mean Federal Aviation Administration
23. FD shall mean Fire Door
24. FDRS shall mean the EDS machine's Field Data Reporting Computer System, which monitors and records the EDS Machine's events, such as BVS operator logins and other data.
25. FLA shall mean Full Load Ampacity or Full Load Amperes
26. FPM shall mean Feet Per Minute
27. FSD shall mean Fire/Security Door
28. HDD shall mean Hard Disk Drive
29. HMI shall mean Human Machine Interface
30. HVAC shall mean Heating, Ventilating and Air Conditioning
31. IATA shall mean International Airline Transportation Association
32. ID shall mean Identification
33. IEC shall mean International Electromechanical Commission
34. I/O Module shall mean Input/Output Module
35. ILM shall mean Wilmington International Airport
36. IT shall mean Information Technology
37. LAN shall mean Local Area Network
38. LED shall mean Light Emitting Diode
39. MCP shall mean Motor Control Panel. The MCP contains the electrical control and power circuit devices for the control of the baggage system(s).
40. MEP shall mean Mechanical, Electrical and Plumbing System
41. MTBF shall mean - Mean Time Between Failures
42. NEC shall mean National Electrical Code
43. NEMA shall mean National Electrical Manufacturers' Association
44. NFPA shall mean National Fire Protection Association
45. NIC shall mean Not In Contract
46. NRT shall mean Near Real Time
47. NTP shall mean Notice-to-Proceed.
48. O & M shall mean Operations and Maintenance
49. OEM shall mean Original Equipment Manufacturer
50. OSHA shall mean Occupational Safety and Health Administration
51. OS shall mean Oversize

Copyright © 2018 by BNP Associates, Inc. (BNP)

52. OSC shall mean the TSA's Office of Security Capabilities
53. OSR shall mean On-Screen Resolution
54. Owner shall mean the New Hanover County Airport Authority
55. PAX shall mean Passenger
56. PDP shall mean Power Drop Point. Designated location(s) for the power supply to the BHS MCPs.
57. PE shall mean Professional Engineer
58. PLC shall mean Programmable Logic Controller, a microprocessor which controls BHS operations.
59. PSI shall mean Pounds per Square Inch
60. RF shall mean Radio Frequency
61. RFI shall mean Request For Information
62. ROW shall mean Right of Way
63. RT shall mean Real Time
64. SAT shall mean Site Acceptance Testing, required for each of the new and existing relocated Stand-alone EDS machines – shall be performed on each EDS machine by the EDS supplier and the TSA's testing contractor
65. SD shall mean Security Door
66. SIDA shall mean Security Identification Area
67. TOB shall mean Top of Belt
68. TSA shall mean Transportation Security Administration
69. TSO shall mean Transportation Security Officer (Baggage Screener)
70. UA shall mean United Airlines
71. UL shall mean Underwriters Laboratories
72. UPS shall mean Uninterrupted Power Supply
73. USS shall mean Uniform Symbology Specification
74. User Airline shall mean those airlines that use the Baggage Handling System(s) related to this contract
75. VFD shall mean Variable Frequency Drive
76. VOM shall mean Volt Ohm Meter
77. WAN shall mean Wide Area Network

B. Authorized Representative

1. The Owner may designate by written notice to BHS Contractor or by provision elsewhere in this Contract one or more persons, firms or corporation to act as its Authorized Representative in connection with the administration of this Contract. Except as otherwise provided in such written notice or elsewhere herein, such Authorized Representative shall have the authority to act for the Owner with respect to the performance of this Contract by the BHS Contractor with the objective of achieving full compliance by the BHS Contractor of the terms and provisions of the Contract.
2. Accept and comply with instructions from such Authorized Representative as though such instructions had been given by the Owner and the BHS Contractor shall deal directly with such Authorized Representative in all matters arising under this Contract, including but not limited to matters involving Contract interpretation, disputes and arbitration procedures. However, such Authorized Representative is authorized to act in connection with this Contract solely as the representative of the Owner and not as principal hereunder.

C. General

1. Baggage Handling System (BHS) shall mean all components, installation materials, interfaces and other components, including, but not limited to all necessary hardware, software, installation coordination and construction supervision of computers/PLC, controls and control hardware and software, management and support services required to implement the work and supply a fully functioning system "Turnkey" system as described by the Contract Documents.
2. Baggage Handling System Contractor shall be synonymous with Equipment Contractor, Equipment Supplier, Baggage Contractor, Supplier and Contractor and shall mean the firm or company that is responsible for the design, engineering, manufacture, modification and installation of the conveyor equipment and systems required to implement the work and supply a fully functioning "Turnkey" system as described by the Contract Documents.

Copyright © 2018 by BNP Associates, Inc. (BNP)

3. In these written Specifications and on the Contract Drawings, the following clarifications/definitions shall apply:

   a. As Built shall encompass all elements of the term As Executed.
   b. Bill of Quantities shall mean a document named therein as a Bill of Quantities issued to bidders by or on behalf of the Owner, stating quantities of work to be carried out.
   c. Completion shall mean:

      1.) That stage of the execution of the Work under the Contract when the Works are completed and all other things, which are required by the Contract to be performed by the BHS Contractor before completion, have been performed and accepted.
      2.) Where contract or specifications provide a period of time for completion, the last day of the period.
      3.) However, if the Owner grants an extension of time for completion, it means the date resulting from the extension of time.

   d. Contract means this Deed of Agreement between the Owner and the BHS Contractor for the performance of the Works, together with all schedules, attachments, annexure and other documents incorporated into this Contract.
   e. Construction Manager shall mean a firm, person, or such other manager as may be appointed by the Owner for the purpose of managing the Contract and, in so far as it concerns the functions exercisable by the Construction Manager, includes his nominated representatives.
   f. Contract Sum means:

      1.) Where the Owner accepted a lump sum, the lump sum.
      2.) Where the Owner accepted rates, the sum ascertained by adding the products of the rates and the corresponding quantities in the Schedule of Rates.
      3.) Where the Owner accepted a lump sum and rates, the aggregate of the sums referred to in paragraphs 1 and 2 above.

   g. Date for Completion shall mean:

      1.) Where contract provides a date for completion that date.
      2.) Where contract or specifications provide a period of time for completion, the last day of the period.
      3.) However, if the Owner grants an extension of time for completion, it means the date resulting from the extension of time.
      4.) The date certified by the Owner in a Certificate of Completion to be the date upon which the Works have reached completion.

   h. Day means a calendar day.
   i. Other Contractor or Other shall mean a firm or person other than the BHS Contractor who shall enter or has entered into a Contract with the Owner.
   j. Project shall mean the construction of the Outbound BHS for the planned Terminal Renovations and Expansion Program at the Wilmington International Airport, as described in these written Specifications and illustrated on the Contract Drawings.
   k. Schedule of Rates shall mean any schedule included in the Contract, which, in respect of any section or item of work to be carried out, shows the rate or respective rates of payment for execution of that work, and which may also include provisional items, provisional sums, quantities and prices. The schedules of rates are fixed sums for the duration of the Contract with the Owner.
   l. Site means the lands and other places made available or to be made available to the BHS Contractor by the Owner for the purpose of the Contract.
   m. Specifications means the Specification for the Works included in the Contract and any modification of such Specification thereafter.
   n. Subsystem shall mean a set conveyor segments and its related field elements (e.g., control stations, Fault Diagnostics Touch Screen Terminals, and the like), which is a system itself, and a part of the whole system.
   o. Temporary Work shall mean any work required in the execution of the Contract but not forming part of the Works.

Copyright © 2018 by BNP Associates, Inc. (BNP)

p. The Contract Drawings shall mean the drawings referred to in these written Specifications or The Contract; the Owner may from time to time supply modifications/revisions of such drawings and other drawings to the BHS Contractor for the purposes of the Contract.
q. The Works shall mean the whole of the work to be executed in accordance with the Contract, including variations provided for by the Contract.
r. Words importing the singular include plural and words importing the plural include the singular.
s. Words importing persons include a partnership and a body corporate.
t. Words importing the masculine gender include the feminine and neuter genders.
u. Work Under The Contract shall mean any work the BHS Contractor is or may be required to execute under the Contract and includes variations, remedial work and Temporary Work.

1.4 BHS EQUIPMENT IDENTIFICATION

A. General

1. The item numbering system and format used for physical identification of new conveyors, including but not limited to their associated field components, devices, control stations, MCPs, junction boxes and in all related documentation shall be consistent with the subsystem identification detailed on the contract documents.
2. All of the BHS equipment in each subsystem shall be numbered in consecutive order.
3. Numbering of all subsystems shall commence from the subsystem's baggage input point to the subsystem's final discharge conveyor segment.

B. Equipment Identification

1. The item numbering system and format used for physical identification of conveyors and associated equipment and in all documentation shall be the same as that indicated on the Contract Drawings.

1.5 SUBMITTALS

A. General

1. This section offers detailed submittal instructions regarding the BHS and is to be used in conjunction with Division 01, sections 013300 and 017839.
2. Submit the following documentation, along with any other documentation required by Divisions 01, in accordance with the following Submittal Deadlines.
3. Prepare all documents in the English language.

B. BHS Contractor Documents Submitted for Review

1. All submittals shall be in compliance with the Division 01, Section 013300 for Submittal procedures. All documents shall be submitted to the Owner in both hard and soft copies (e.g. text documents in MS Word and searchable PDF format, drawings in AutoCAD [.dwg or .dwf] and PDF format).
2. The baggage handling design documents are performance based/type documents. Provide the BHS Contractor's complete design including all baggage handling conveyor segments, power and control panels with associated distribution panels, control system design, maintenance diagnostics and service zones complete as the primary component of coordination. All other systems defined in the Contract Documents are to be secondary to the baggage handling system.

C. Submittal Deadlines

1. Listed below are the submittals and dates referred to in the applicable sections. (Indicate in the proposal submission if an adjustment to these dates is required (days indicated are calendar days)).

Submittal Item	Deadline
Submittal Register/Log	7 days after NTP and with

Copyright © 2018 by BNP Associates, Inc. (BNP)

Submittal Item	Deadline
	each submittal or as coordinated by the Owner or their Representative
Safety Program Manual	10 days after NTP for review with approved copy at the Pre-installation Meeting
Project Organization Chart and Management Team	10 days after NTP for review with approved copy at the Pre-installation Meeting
Quality Control Manual	15 days after NTP for review with approved copy at the Pre-installation Meeting
Configuration Management Plan	15 days after NTP for review with approved copy at the Pre-installation Meeting
Detailed Master Schedule, including list of Submittals	15 days after NTP
Phasing Schedule	30 days prior to commencement of the respective phase.
Sample of "Work Activities Bulletin"	30 days after NTP
Structural Attachment Details	30 days prior to fabrication of BHS equipment
Environmental Requirements	30 days after NTP
Catalog Cuts and Equipment Specifications	30 days after NTP
System Power Requirements and MCP Sizes	30 days after NTP
BHS Equipment - Combined Heat Output Figures	45 days after NTP
Emergency Stop Zone Drawings	45 days after NTP
Controls System Description (Detailed Functional Specification), Interface Requirements with Building Access Control and Fire Alarm Systems	45 days after NTP
Shop Detail Drawings (to include details of specified safety guarding)	45 days prior to fabrication
Motor Schedule	60 days prior to fabrication of BHS equipment
Installation Drawings	60 days prior to fabrication
Training Program	30 days prior to turn-over of BHS equipment for beneficial use
Estimated Parts List	45 days prior to turn-over of BHS equipment for beneficial use
Inspection, Functional Specification and Test	60 days prior to Acceptance

Copyright © 2018 by BNP Associates, Inc. (BNP)

Submittal Item	Deadline
Program	Inspections/Testing
Final Parts List	30 days prior to turn-over of BHS equipment for beneficial use
Work Activities Bulletin	14 days prior to each activity
Test Reports	14 days after completion of Acceptance Inspections/Testing
Certificate of Testing Compliance	14 days after completion of Acceptance Inspections/Testing
System Reliability Calculations	14 days after completion of Acceptance Inspections/Testing
Certificate of Installation Compliance	14 days after completion of Acceptance Inspections/Testing
As-Built Drawings	30 days after Acceptance Inspections/Testing
List of Lubricants	30 days prior to turn-over of BHS equipment for beneficial use
O & M Manual – Draft for Owner Review	45 days prior to turn-over of BHS equipment for beneficial use
Periodic Maintenance Inspection and Lubrication Chart	30 days prior to turn-over of BHS equipment for beneficial use
O & M Manual – Final	14 days prior to turn-over of BHS equipment for beneficial use
Semi-Monthly Status Reports	The 15th day and last day of each month
Computer/Software/Hardware Inventory	At Conditional Acceptance of BHS/ and updated as required during the Final Acceptance of BHS.
Computer Log	To be kept during Conditional Acceptance period and officially submitted at completion of the at Final Acceptance of the BHS.

D. Detailed Master Schedule

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. General

    a. Details of the Master Schedule as relating to the BHS in this specification section are to be coordinated with the applicable requirements of Division 01.

2. Submit a detailed Master Schedule as specified below for review and approval by the Owner or their Representative before commencing with any work. Display schedule in graphic form, large and spacious enough to be updated directly on the original submittal during the course of the project. Show the principal dates and commensurate activity times for each entry. Include in the schedule:

    a. Beginning and ending of mechanical, electrical and controls/computer engineering for each subsystem of construction.
    b. Drawing submittal and approval.
    c. Long lead item order placement and expected delivery date.
    d. Beginning and ending of fabrication per subsystem of construction.
    e. On-dock plant to on-site transportation.
    f. Beginning and ending of mechanical, electrical and controls/computer installation per subsystem of construction.
    g. Milestone dates for completion of pertinent facility interfaces (e.g., permanent system power, Access Control, Fire Alarm, Network Interface to BHS PC-type Computer Terminal Workstation).
    h. Date(s) EDS Machines (Reveal CT80's) rigging / relocation needs to be completed by the TSA's Contractor
    i. BHS Contractor's internal specification conformance acceptance test dates
    j. Training and test plan submittals.
    k. Submittal of operation and maintenance manuals.
    l. Operation and maintenance training periods.
    m. Submittal of manufacturer's recommended spare parts list.
    n. Acceptance inspections, testing/commissioning by subsystem.
    o. Operational dates by subsystem or construction sequence.
    p. Punch list rectification.
    q. Final acceptance testing.
    r. Submittal of As-Built documentation.

3. Maintain and update the Master Schedule bi-weekly showing the actual progress made and any revisions in the schedules or at any time that changes in the design, construction, procurement and installation cause any major change in the overall schedule. Required reporting frequency intervals may be shorter during critical periods at the discretion of the Owner or their Representative. Such additional reporting frequency shall not be grounds for additional cost claims.
4. If the bi-weekly schedule update reflects, or the Owner or their Representative determines, that the BHS Contractor is at least ten percent (10%) or fourteen (14) or more calendar days behind the original progress schedule (whichever is less) for the BHS project as a whole, a major Contract item, an item of BHS which is on the critical path, or an item of BHS not on the original critical path but that, because of the delay or anticipated delay, becomes a critical path item, then the BHS Contractor must submit its proposed recovery plan for bringing the BHS project back on schedule and for completing the BHS within the Date of Completion with the bi-weekly schedule update.
5. Coordinate and interface all BHS related work that is in line with the facility alterations of the Terminal BHS with other contractors working on site. Such co-ordination and interfacing shall include for permitting the direct contractors to complete their work before proceeding to complete the balance of the project under this Contract. In the event of failure by the BHS Contractor to allow for such co-ordination and interfacing, no claim whatsoever shall be entertained by the Owner for any additions, amendment, re-medial or abortive works to be carried out by the BHS Contractor(s) to ensure satisfactory completion of the project. Obtain the overall project schedule from the Owner and other such direct contractors and include them into the Master Schedule.
6. The BHS Contractor may also request revisions to the Project Schedule in the event the BHS Contractor's planning for the work is revised. If there are desired changes in the Project Schedule to reflect revisions in the method of operating and scheduling of the work, notify the Owner or their Representative in writing, stating the reason for the proposed revision.
7. Ensure there are sufficient personnel available for the purpose of coordination to ensure timely

Copyright © 2018 by BNP Associates, Inc. (BNP)

completion of the BHS and to ensure that the BHS Contractor does not hinder the work of other trades. Provide personnel with the required experience for coordination at meetings as required by the Owner or their Representative so that decisions regarding coordination issues can be made during coordination meetings.

E. Detailed BHS Phasing Plans

1. Construction Phasing shall be in accordance with the Project's schedule, as defined by the Contract Documents. Coordinate with all contractor disciplines on site for this project and with the Owner or their Representative to develop a BHS installation Phasing plan.
2. Submit a detailed Phasing plan for each subsystem designated for installation, complete with illustrations (e.g., partial plans of BHS activities), description of work, staffing requirements and schedule for the overall BHS scope of work. The overall plan with associated schedule shall be broken-down on a subsystem basis or BHS phase, as applicable and as coordinated with the project team.
3. Refer to Part 3 of this Specification Section (347739) for the BHS Phased Implementation General Requirements and for the detailed summary of the Phasing Program.

F. Structural Attachment Details

1. Submit structural and seismic attachment detail drawings and the design computations of all structural supports for the BHS and associated catwalks signed and sealed by a Professional Structural Engineer licensed in the State of North Carolina, the same jurisdiction where this project is located.
2. Submit for review the design and locations of all structural attachment points, wherever the equipment is to be supported by the building structure. Show, as a minimum, the type of anchor device to be used and the amount of load to be imposed on the building structure.
3. Take into consideration the location of any building expansion joint locations which can affect the layout / installation of the conveyor or of structural attachment points.
4. Submit a complete vibration isolation-drawing package, showing isolation type, as well as method and location of installation.
5. Submit a list of successful projects, which used the type of BHS attachments and vibration isolation package being proposed for this project.
6. The allowable conveyor equipment loads that are permitted to be imposed on the building structure are referenced in the contract documents. If different loads are considered, higher than what is illustrated in the contract documents, coordinate with the Owner’s structural engineer and provide a BHS support system that will distribute the conveyor equipment loads so they do not exceed the maximum allowance that is referenced in the contract documents. The design and installation of the BHS support system and associated structural attachments to the building structure shall be in conformance with the allowable loads of the building structure and ensure that all State and Local codes for seismic requirements are met and abided by for this project. Coordinate with the Architect’s structural engineer to ensure that all State and Local codes for any seismic requirements are met and abided by for this project.

G. Shop Drawings, Installation Drawings, and As-Built Documents

1. General

a. All drawings submitted shall become the property of the Owner.
b. All drawing submittals shall be to scale. The scale utilized shall be clearly defined in the title block.
c. The North arrow shall also be shown on all mechanical drawings.
d. Drawings shall include the following items unless otherwise specified.

1.) Document Title Blocks

a.) In addition to information normally presented in a drawing title block, each drawing title block shall provide the following specific information:

(1.) Three letter airline code for airport designation of the project location

Copyright © 2018 by BNP Associates, Inc. (BNP)

(2.) Name of the Baggage Handling System
(3.) Drawing scale
(4.) Drawing title
(5.) Drawing number/sheet number
(6.) Drawing date
(7.) Drawing revision date and revision number
(8.) NOTE: All drawing revisions shall be foot noted on the drawing face as well as in the appropriate revisions section of the title block.

e. Professional Engineer Approval Requirements

1.) Submit all applicable drawings and calculations signed and sealed by a Professional Engineer licensed in the State of North Carolina, the same jurisdiction where this project is located.

2.) Minimum requirements for Professional Engineer signed and sealed drawings and calculations to be submitted are defined below. Submit any additional signed and sealed drawings, calculations or submissions required by federal, state or local codes. As a minimum, the following drawings, calculations and submissions shall be signed and sealed at no additional cost to the project:

a.) Mechanical/Structural

(1.) All structural and, if necessary, seismic attachment details and design computations for the BHS and associated catwalks
(2.) All structural support details and design computations for the BHS and associated catwalks
(3.) Drawings and design computations of all structural attachment points to the parent building including imposed load on the building
(4.) Drawings defining all structural supports and attachment types and locations. Generic details will not be acceptable for this purpose.
(5.) Take into consideration the location of building expansion joint locations, which can affect the layout / installation of the conveyor or of structural attachment points.
(6.) Drawings defining all maintenance catwalks and methods of catwalk access including details of handrails, access stairs and ladders, and catwalk construction details.

b.) Electrical

(1.) All BHS motor control panel connected load calculations

c.) Provide the above mechanical/electrical PE signed and sealed drawings/calculations as listed above in part a.) and b.) in two separate submittals:

(1.) "For Construction" drawings/calculations
(2.) Final "As-Built" drawings/calculations

2. Drawing Submittal Package Requirements

a. Submit final installation and detail drawings defining BHS erection procedures, mechanical and electrical component layouts, including details of the specified safety guarding, and the relationship of the equipment components to each other and to the facility prior to the commencement of fabrication.
b. Submit a motor schedule listing: The motor schedule shall include the motor horsepower, voltage, source of feed, circuit breaker size, disconnect size, conduit and wire size and overload heater size selected to be used – The motor schedule listing shall be submitted prior to the installation of overload heaters on the controllers.
c. Submit the BHS equipment combined heat output figures with calculations for the following areas of the facility. Any areas of heat build-up concern (especially enclosed areas) shall be identified and documented. The information typically includes friction losses from conveyor equipment and heat outputs from the drive motors, motor control panels and computer

Copyright © 2018 by BNP Associates, Inc. (BNP)

equipment:

d. Submit As-Built drawings as per the specified submittal schedule (plans and associated sections/elevations) indicating the location of the BHS, including all mechanical components, maintenance catwalks and electrical devices, operator's control panels, MCP, switches, and other control devices. The As-built documentation shall be submitted to the Owner, consistent with the requirements of this specification. Ensure that the submitted "As-Built" documents and related information are issued on media that is acceptable to the Owner, is accurate, and includes all BHS related Communication/Network Layout drawings, Final Descriptions of Operations, Final copy of the Programmable Logic Controller (PLC) programs with all relevant drawings, Final copy of BHS MCP Touchscreen Terminals, PC-type Computer Terminal Workstation and PLC software disaster recovery procedures, Computer Crash Recovery Disks and all operations and maintenance manuals. All final As-built drawings shall be signed and sealed by a Professional Engineer licensed in the State of North Carolina at no additional cost to the project.

e. Submit final assembly drawings, shop detail drawings and any other pertinent drawing files in AutoCAD.DXF format, version 2018 or higher and in searchable PDF file format, for all areas of the work, indicating BHS components, construction, painting, and assembly details of all components prior to releasing drawings for fabrication.

f. As-Built drawings shall be submitted on media that is acceptable to the Owner, along with one (1) hard copy full size and one (1) hard copy half size set .

3. BHS Mechanical Drawing Submittal Requirements

a. General

1.) If standard parts are purchased, reproduced details and identifying part numbers shall be provided.

2.) Each BHS device or conveyor that appears on plan, elevation and section drawings of the BHS shall be identified with the appropriate I.D., as established in this Specification.

3.) Number conveyor equipment and control devices starting at the beginning of each conveyor system or subsystem.

4.) All plan views of the BHS shall be based on an overlay of the building structure as is appropriate. AutoCAD architectural backgrounds may be requested from the Architect through the Owner or their Representative.

5.) All plan, elevation and section drawings of the BHS shall also show the vertical and horizontal clearances between the related system equipment and the building structure with its related interferences.

6.) Section drawings of the BHS shall include, at a minimum, of one section drawing in the exact plane as the sections shown in the Contract Drawings. These section drawings shall show all BHS systems in that plane (i.e., depict all BHS subsystems cut by that plane).

b. Provide the following types of mechanical drawings:

1.) General arrangements with dimensions of all new equipment (plan, elevation, details and sections, as appropriate) for all mechanical, conveyor equipment, maintenance catwalks, crossovers, ladders (coordinate with the Architect and the Owner or their Representative for the final number and location of all maintenance access equipment), impact protection, electrical motor control panels, electrical equipment support, electrical control stations, relocated existing EDS machines and their associated equipment for overall system reference.

2.) Drawings with the appropriate level of detail, as noted in the contract documents, shall be provided for any equipment designed and manufactured for this project.

3.) Detailed drawings are required for all BHS equipment framing, supports, hangers, and other required structures.

4.) Detailed drawings indicating locations and type of safety signage.

5.) Detailed drawings with dimensions of all safety guards such as, but not limited to, the following:

Copyright © 2018 by BNP Associates, Inc. (BNP)

a.) Conveyor underpans
b.) Rotating shaft guards
c.) Conveyor shrouds
d.) Drive v-belt / chain guards
e.) Metal bearing covers
f.) Finger guards
g.) Gap pans
h.) Drive pans
i.) Breakaway end cap safety guards

4. BHS Electrical Drawing Submittal Requirements

a. General

1.) Each BHS device or conveyor and related control and power devices that appear on any electrical drawings of the BHS shall be identified with the appropriate I.D., as established in this Specification.

b. Submit the following types of electrical drawings:

1.) Plan view of the BHS noting the identity and location of all Motor Control Panels, control devices, control station, motor, limit switches, safety disconnect switches, junction boxes and the like as related to each BHS device of the subsystem. These drawings shall be provided with the following information:

a.) Detailed wiring connections for the above referenced field components, in block form, with a detail of the actual field wiring numbers and configuration.
b.) Detailed conduit routing diagrams indicating the size of conduits and the size/number of conductors for the above referenced equipment/components and associated MCPs that shall also include their respective feeders and references to their main power supply sources (i.e., Facility Power Source(s)).

2.) Layout of MCPs detailing installation / location of control devices or indicating lamps.
3.) Submit all power requirements for the subsystems of this project as per the specified submittal schedule. Any discrepancies between the specified maximum allowable electrical loads and BHS Contractor design loads shall be clearly identified in the review submission. The Owner shall retain the right to reject any and all requests for additional power beyond those as indicated in the Contract Documents. System power requirements shall be calculated in accordance with the recommended practice and shall include connected and demand power. Provide an assessment for review and approval, identifying compliance with NFPA 70E Standards for Electrical Safety in the Workplace regarding the BHS MCPs that are part of this project and the need for personal protective equipment.
4.) Detailed drawing indicating locations, size and type of safety signage for the BHS.
5.) Detailed block diagram of the BHS related components to provide a functional overview of the system architecture and a conduit routing diagram that shall illustrate the actual installation and location of components. These drawings shall distinguish the difference between the BHS Contractor provided components and non-BHS Contractor components that the BHS will interface with (i.e., other Airport systems). The overall submittal of these documents shall include specified redundancy provisions and related communications links to new systems (i.e., location of all network devices, switches, routers, repeaters, media converters, fiber connections, terminations, and the like). All components shall be identified and shall include their respective part numbers, as applicable.
6.) Programmable Logic Controller (PLC) computer control system in block diagram format to include the data communication system showing the connections among all PLCs, MCP Touchscreen Terminals, Baggage Handling PC-Type Computer Workstation and remote I/O units, if utilized.
7.) Motor Manifest indicating type, part number of driven equipment, power in

Copyright © 2018 by BNP Associates, Inc. (BNP)

horsepower, full load amperes and speed.

8.) MCP general layout showing enclosure size, type, power requirements, equipment location and enclosed component general arrangement. Include a separate I/O list for each PLC or remote I/O in the panel. Identify I/O assignments with Equipment Item Numbers for all equipment.

9.) Detailed block diagram representing internal layout of components within each motor control panel, both internal as well as external layout of components.

c. Submit the following types of control system drawings:

1.) Plan view of the BHS noting the identity and location of each control device, control station, motor, limit switches, safety disconnect switches, and the like as related to each BHS device of the system.

2.) Plan view of the BHS noting the identity and location of each motor with power in horsepower. Identify all motors that will have a VFD, clutch/brake or brake. If VFDs are utilized in the project, annotate which motors are controlled by Variable Frequency Drives and indicate the location of the VFD (either at the motor or located in the relevant MCP). If clutch/brakes are utilized in the project, annotate which motors are controlled by clutch/brakes and indicate the location of the clutch/brake (either at the motor or located in the relevant MCP).

3.) Plan view of the BHS noting the identity of each conveyor with expected speed in feet per minute.

4.) Plan view of the BHS noting the identity of every photocell location.

5.) A set of drawings showing those conveyors that will stop by the activation of each specific Emergency Stop in the system as per the specified submittal schedule. The drawings should indicate (using different colors or hatches) the conveyors of the specific subsystem and any adjacent subsystems that will stop for each emergency stop or group of emergency stops as appropriate. Emergency Stop functions shall be in accordance with the operational design principles as specified within the Contract Documents and shall incorporate the highest standard of safety to prevent hazardous conditions. The Emergency Stop Zone requirements and associated controls for the BHS shall be consistent with the functional operation that is specified elsewhere in this document. Consider the following when developing the e-stop zones:

a.) When splitting up e-stop zones, consideration shall be given to the MCP breaks. If the downstream MCP is shut down, upstream bags that are left in the system should be able to divert prior to the equipment that is inoperable.

b.) 45° merge e-stops should be tied into the receiving or take-away conveyor.

d. Submit detailed shop drawings which include all interfaces between systems that are affected by the scope of work and shall include but is not limited to connection details (connector type, communication protocol) software protocol, transmission media, location of connections and any other required information. The types of interfaces include; MCP Touchscreen Terminals, PC-type Computer Terminal Workstation, Building Access Control System and Fire Alarm system. A complete list of ports/protocols relative to source and destination shall be defined in the submittal of the MCP Touchscreen Terminals, BHS PC-type Computer Terminal Workstation and Controls system between each interfaced system communicating on the BHS.

e. Provide an approved 11" x 17" reduced copy of the schematic wiring diagram(s) of each MCP including outline and wiring diagram of all special devices which shall be placed in the door pocket of the MCP.

5. BHS MCP Touchscreen Terminals, PC-type Computer Terminal Workstation, and Controls System Description Submittal

a. Submit a Control System Description as specified in Parts 2 and 3 of this specification, summarizing the proposed outbound BHS architecture, general design, redundancy, considerations, related components/devices, including Touchscreen Terminals and overall subsystem functionality, as well as interfaces with other systems (ports/protocols relative to source and destination for each system communicating on the BHS).

Copyright © 2018 by BNP Associates, Inc. (BNP)

b. The Baggage Handling Controls System submittals shall also include an application matrix/interconnection diagram of the complete system, along with a comprehensive list of ports/protocols relative to source and destination for each system communicating on the BHS network.

H. Catalog Cuts and Equipment Specifications

1. Submit a catalog cuts manual for all manufactured and purchased items (mechanical, electrical and computer equipment) as per the specified submittal schedule.
2. The catalog cut manual shall contain the following:

   a. Record of Revisions: A "Record of Revisions" sheet shall be provided at the beginning of the catalog cut manual.
   b. Table of Contents: A Table of Contents shall be provided at the beginning of the catalog cut manual.
   c. Index Tabs: Each catalog cut shall be identified with an index tab with permanently printed information.

3. The catalog cuts must be completely legible and reproducible, directly relevant to the specific items as used in the system. Each individual item shall be clearly indicated by the inclusion of a highlighted/shaded arrow immediately adjacent to the item. Where a variation occurs from the standard component or a special custom ordered part has been used as a replacement for the standard supply, additional details shall be submitted to clarify the identity of the component.
4. The catalog cuts shall include the following items (this list is not to be construed as being complete since it is provided only as a guide):

   a. Speed reducers
   b. Motors
   c. Bearings
   d. Pulleys and rollers
   e. Motorized pulleys
   f. Belting
   g. Roller chain and sprockets
   h. Belts and sheaves
   i. Safety Guards and associated tamper proof fasteners
   j. Queue conveyors
   k. 45° merge conveyors
   l. Power turns
   m. Wiring devices
   n. Control devices
   o. Soft starts, electronic
   p. Electric brakes
   q. Electric clutches (if utilized in the project)
   r. VFDs (if utilized in the project)
   s. PLC and peripherals
   t. Power regulators
   u. MCP Touchscreen Terminals
   v. Computer equipment
   w. Computer monitors
   x. Slope Plate devices
   y. Building Fire Alarm and Building Access Control Systems Interface Components

I. Operation and Maintenance Manuals

1. General

   a. Provide Operation and Maintenance (O&M) Manuals (in binders) for the BHS subsystems as per the format and guidelines specified below.

2. Purpose

Copyright © 2018 by BNP Associates, Inc. (BNP)

a. The prime purpose of the Operation and Maintenance (O & M) Manual shall provide the Owner's operational and maintenance personnel with a thorough understanding of the layout of the system, its function, special features, operational requirements, maintenance requirements, parts information, warranty information, and safety considerations including operational and maintenance access requirements for operating and maintaining the system safely and effectively.
b. This specification is intended as a guide to indicate the basic requirements of the O&M Manuals. The BHS Contractor's standard O&M Manual shall be acceptable provided it is functionally equivalent to that specified below and the documents are suitable and usable for the intended purpose.
c. The manual is to be divided into two main sections:

1.) The Operational portion of the manual shall present the information required for personnel to be able to operate the system in a safe and efficient manner. The operational information shall be presented in easy to understand terms to ensure that personnel not familiar with the system will have a thorough understanding of the system upon reading the operational information.
2.) The Maintenance portion of the manual shall present the information required for personnel to be able to maintain the system in a safe and efficient manner. The maintenance information shall be presented in easy to understand terms to ensure that personnel not familiar with the system shall have a thorough understanding of the mechanical and electrical equipment operation and maintenance requirements so that they shall be able to effectively and safely perform maintenance functions such as troubleshooting, servicing, and repairing.

3. Binder Type

a. Binders shall be of the "presentation" type equipped with "D" rings designed at three (3) hole punch standard insert. Additionally, the binders shall be equipped with a clear spine pocket to permit the insertion of the manual title for identification.
b. Binders shall be of sufficient size (number of pages) to be used by a reader with no difficulty of access. Also, the documents as bound within the binder shall not be damaged by lack of free space for movement both during storage and use.
c. Standard "letter" size format (8.5" x 11") shall be the basic size parameter for the binder selection.

4. Format

a. The O & M Manual shall be contained within at least two (2) volumes of appropriate size segregating the Operation and Maintenance information. Note that additional volumes may be required to accommodate multiple operational or maintenance information chapters.
b. The title information shall be generally as follows:

1.)	First line:	Three letter code of the airport in which the system is located (e.g. ILM).
2.)	Second line:	"Operations Manual" or "Maintenance Manual"
3.)	Third line:	"For"
4.)	Fourth line:	Type of system: (such as: Wilmington International Airport Terminal Renovations and Expansion Program of the Outbound Baggage Handling System
5.)	Fifth line:	Date of System, as based on actual beneficial use date
6.)	Sixth line:	Project Number (to be Coordinated with the Owner or their Representative)

5. Contents of Manual

a. Record of Revisions: A "Record of Revisions" sheet shall be provided at the beginning of the O & M Manual.
b. Table of Contents: A Table of Contents shall be provided at the beginning of the O & M Manual.
c. Chapter Index Tabs: Each chapter shall be identified with an index tab with permanently

Copyright © 2018 by BNP Associates, Inc. (BNP)

printed information.

d. Chapter Index: Each chapter of the O & M Manual shall begin with an index for the related chapter.

6. Operational Information

a. Chapter 1 - Glossary of Operational Terms

1.) Include a glossary of operational related terms and equipment identification/designations.

b. Chapter 2 - System Overview

1.) Include, at a minimum, the following items:

a.) A basic overview of the system showing overall layout and arrangement.
b.) Identify locations, number of and types of inputs.
c.) Identify system and subsystem conveyor designations.
d.) Processing rate of each subsystem as well as the total system-processing rate.

c. Chapter 3 - Baggage Weight and Size Limitations

1.) Include, at a minimum, the following items:

a.) Normal Size Baggage
b.) Baggage that can be processed by system but requires special considerations/handling such as but not limited to skis, and golf bags.
c.) Fragile Baggage
d.) Oversize Baggage

d. Chapter 4 - Detailed Description of System Operation

1.) Include, at a minimum, the following items written in a clear concise manner:

a.) The detailed operational description of system operation must be written to provide operational personnel a thorough understanding of how to operate the system. Operational personnel include:

(1.) Sky Caps
(2.) Passenger Service Ticket Agents
(3.) Service Baggage Handlers
(4.) TSA Agents

b.) The operational information shall cover system start up, shut down, operational stop/start control stations, Jam Reset and Emergency stop operational requirements.
c.) The operational information shall also provide a thorough understanding of the system fault annunciation system so that faults can be recognized, and appropriate action can be directed.
d.) The operational information shall provide an operator's troubleshooting guide for the safe and effective correction of operational problems.

2.) The BHS shall be equipped with a BHS PC Type Computer Terminal, with its respective Workstation monitor and BHS MCP Touchscreen Terminals; Submit detailed information for the items noted below, affected by the specified requirements of this project (this list is not to be construed as being complete and is provided only as a guide):

a.) All operator interface command entries
b.) All operator initiated reports
c.) All system automatically generated reports
d.) All system fault alarm messages and reports
e.) All HMI and graphic display information systems
f.) Placing equipment "in" or "out" of service

Copyright © 2018 by BNP Associates, Inc. (BNP)

3.) Baggage Loading Procedures - The detailing of the above information shall include (but not be limited to):

a.) Thorough explanation and purpose of the command message or report.
b.) Required keyboard or operator response.
c.) Explanation of expected system response

4.) The operator's information must also include procedures and recommendations for alternative modes of system operation as may be required due to various equipment or subsystem failures.

e. Chapter 5 - Operational Safety

1.) Submit safety information related to the proper and safe operation of the specified system and its equipment from an operator's point of view and at a minimum must cover the following items (this list is not to be construed as being complete since it is provided only as a guide):

a.) Pre-operating procedure
b.) Start up and Shut down Procedure
c.) Emergency Stop and Restart Procedure
d.) Jam Detection, Jam Clearance (including consideration of bag removal/repositioning) and Restart Procedure
e.) Equipment Lockout/Tag-out Procedures (the procedure shall reflect/refer to the most current OSHA, ANSI and Local Code, Policies and Standards)

f. Maintenance Information

1.) Chapter 1 - Glossary of Terms and Identification

a.) Include a glossary of all terms and equipment identification/designations associated with the specified system. Any industry vernacular, vocabulary, descriptions or definitions necessary for further communication of information shall also be provided.

2.) Chapter 2 - Description of System Equipment

a.) Include, at a minimum, the following items:

(1.) Detailed description of the mechanical conveyor equipment used in the system including widths of conveyors, general specifications and capabilities of the system.

(2.) Detailed description of the electrical equipment used in the system, including the function and location of motor control panels (MCP(s)), PLC(s), fire/security door(s), MCP Touchscreen Terminals and PC Type Computer Terminal Workstation.

3.) Chapter 3 - Electrical Control Sequence of Operation

a.) Include a detailed description of the electrical control sequence of operation and the proposed locations of related field equipment/components, such as the items listed below (this list is not to be construed as being complete since it is provided only as a guide):

(1.) Location and operation of Control Stations.
(2.) Location and operation of Photocells.
(3.) Location and operation of Limit Switches.
(4.) Operation of MCP(s).
(5.) Operation of PLC(s).
(6.) Operation of Fire/Security Door(s).
(7.) Operation of the PC-type Computer Terminal with its respective Workstation monitor, as well as MCP Touchscreen Terminals.

4.) Chapter 4 - Maintenance Safety Procedures

Copyright © 2018 by BNP Associates, Inc. (BNP)

a.) Submit safety information related to the proper and safe operation and maintenance of the specified system and its equipment from a maintenance point of view and at a minimum, the following items shall be covered (this list is not to be construed as being complete since it is provided only as a guide):

(1.) Pre-operating Procedure
(2.) Start-up and Shut-down Procedure
(3.) Emergency Stop and Restart
(4.) Jam Detection, Jam clearance (including consideration of bag removal / repositioning) and Restart Procedure
(5.) Equipment Lockout/Tag Out Procedure (the procedure must reflect/refer to the most current OHSA, ANSI, and local codes, policies and standards)

5.) Chapter 5 - Service, Inspection and Preventive Maintenance

a.) Submit detailed information for the proper servicing of all of the system equipment and at a minimum must cover (this list is not to be construed as being complete since it is provided only as a guide):

(1.) A general explanation, regarding the servicing requirements for the related system equipment.

(2.) Detailed preventive maintenance program outlining required functions and frequencies for the proper preventive maintenance of the components that make up the system equipment items such as belt conveyors, power turns, and slope plate devices, computers, fire/security doors, motor control panels. At a minimum, the following items shall be covered however; this list is not to be construed as being complete since it is provided only as a guide. It shall be noted that the information shall be "brand specific" for the actual equipment provided for this system only. Information for equipment types and brands not provided in this system will not be acceptable.

(3.) Inspections for:

(a.) Straight Conveyors, Power Turns, and Merge Conveyors, Slope Pallet Device.

(4.) Lubrication of:

(a.) Motor Bearings, Pulley Bearings (as required), Drive Chains, Speed Reducers, and Power Turn Perimeter Chains/Guides, and all other items requiring lubrication.

(5.) Cleaning of:

(a.) Motors, Drive Chains, Speed Reducers, Photocells (and related reflectors), and Motor Control Panels, MCP Touchscreen Terminals, BHS PC-type Workstation.

(6.) Adjustment of:

(a.) Straight Conveyor Belt Tracking, Straight Conveyor Belt Tensioning, Power Turn Conveyor Belt Tracking/Tensioning, Merge Conveyor Belt Tracking/Tensioning, Slope Pallet Device, Drive V-Belt and Sheave Alignment, Drive Chain and Sprocket Alignment, Drive Chain Tensioning, Photocell alignment and sensitivity, Drive Motor Clutches, and Drive Motor Brakes.

6.) Chapter 6 - Warranty Information and Procedures

a.) Submit detailed information regarding the specific Warranty Conditions that

Copyright © 2018 by BNP Associates, Inc. (BNP)

prevail on the specified system.

b.) Additionally, the detailed information regarding the system warranty must include the following:

(1.) Date of Beginning and Expiration of Warranty Period.
(2.) Specific instructions regarding the procedures for the documentation and return of items under warranty.
(3.) Provide detailed information regarding the specific warranty conditions that apply to the specified system, assemblies, components and parts
(4.) Names and telephone numbers of the "point of contact" for warranty questions and discussions. Note that the "point of contact" information shall be provided for both "normal" 0800 to 1700 Monday through Friday hours as well as "after hours". Direct communication shall be made available 24 hours/day, 7 days/week, 52 weeks/year.

7.) Chapter 7 - Troubleshooting

a.) Submit detailed information for the proper remedial and corrective action required (troubleshooting) for repair of the system equipment malfunctions.
b.) At a minimum, the following items must be included in a detailed "problem and correction" type of troubleshooting chart (this list is not to be construed as being complete since it is provided only as a guide):

(1.) All mechanical equipment
(2.) All electrical equipment
(3.) All control equipment
(4.) All computer equipment
(5.) BHS/Airport Systems Interfaces (e.g. Fire Alarm and Building Access Control Systems).

c.) The troubleshooting information provided in the chart is to cover an exhaustive list of possible causes of system failure or malfunction.
d.) A procedural approach should be used in the documentation to allow service personnel to resolve problems. This method shall emulate the actual problem as well as provide the related solution. Information should be provided to assist in discernment of cause and effect issue as well as find solutions through cross referencing.
e.) The information is to be arranged in a three (3) - column format with respective headings of:

(1.) Trouble
(2.) Probable Cause
(3.) Corrective Action.

f.) Empirical Readings: This chapter shall include the Empirical Readings, as noted in “Testing and Acceptance” section of this Specification that were recorded at the time of the Conditional Acceptance Testing and Inspection of the system. This information is to be provided as a maintenance reference.

8.) Chapter 8 - Removal and Installation Procedures

a.) Submit detailed information for the proper removal and installation of all of the system equipment components.
b.) The information shall be "brand specific" for the actual equipment/components provided for this system only. Information for equipment/components types and brands not provided in this system will not be acceptable.
c.) At a minimum, the following items shall be included in this chapter (this list is not to be construed as being complete since it is provided only as a guide):

(1.) Basic Considerations

Copyright © 2018 by BNP Associates, Inc. (BNP)

(2.) Safety Precautions
(3.) Procedural Orientation
(4.) List of special tools, gauges and equipment required for the maintenance of the system, together with illustrations and instructions as to how they are to be used. Sources for procurement of these items shall also be provided.
(5.) Torque Values
(6.) Drive Chain Tension Procedures and Values

d.) Submit a tabulated listing of all Conveyor Equipment / Component with related information on removal and installation procedures for the following (this list is not to be construed as being complete since it is provided only as a guide):

(1.) All the components for straight conveyors.
(2.) All the components for power turn conveyors.
(3.) All the components for merge conveyors
(4.) All the components for queue conveyors
(5.) All the components for slope pallet make-up device
(6.) All the components for MCPs

9.) Chapter 9 - Illustrated Parts Information

a.) Illustrated parts information shall be provided for all systems, assemblies, subassemblies, components and parts, including but not limited to all mechanical, electrical, workstation computer, and other necessary equipment.
b.) Clear, concise exploded view isometric drawings showing the parts, the relationship of adjacent parts with one another within a given conveyor equipment assembly as well as the diagram number that shall reference the specific part on the adjacent parts information sheet.
c.) The parts information sheet shall be adjacent to the isometric drawing and shall contain:

(1.) Part reference number from isometric drawing
(2.) Part description
(3.) Part Number
(4.) Manufacturer of part
(5.) Number of parts found in the conveyor equipment isometric drawings

d.) Submit the above information in a manner so that the isometric drawing (up to 11" x 17" that can be folded up) shall be on the left hand side of the open manual with the associated parts information sheet as the right hand page of the open manual.
e.) Include model and serial numbers for all special equipment such as power turn conveyors and the like. All parts shall be referenced to a “next-higher-assembly” level within the drawing hierarchy. The system of referencing shall allow the reader to follow assembly / disassembly procedures in a methodical and orderly manner throughout the documentation.

10.) Chapter 10 - Manufacturer's Literature

a.) Submit all of the manufacturer's literature for all of the conveyor equipment mechanical, electrical and electronic components.
b.) Information shall be "brand specific" for the actual equipment/components provided for this system only. Information for equipment/components types and brands not provided in this system will not be acceptable.
c.) Unless unavailable, the actual original manufacturers literature shall be provided. At a minimum, only a first copy of a manufacturer's original literature will be accepted if the actual original manufacturer's literature cannot be provided.
d.) All such copies shall be clear and legible.

Copyright © 2018 by BNP Associates, Inc. (BNP)

e.) All manufacturers' literature shall be appropriately highlighted with a legible solid black arrow for identification of the specific model or type of device used in the specified system.

f.) All manufacturers' literature shall include information adequate for proper servicing of the item, proper operation of the item as well as all required information for the ordering of the item.

g.) Complete list of parts manufacturers including address, telephone number and point of contact.

11.) Chapter 11 - Mechanical Drawings

a.) Record (As-Built) BHS mechanical drawings shall be provided as a complete, clear and legible 11" x 17" set of "As-Built" BHS mechanical drawings. Additionally, a searchable PDF copy of these drawings shall also be provided on media that is acceptable to the Owner and inserted into a sleeve pocket within this chapter.

b.) The 11" x 17" drawings are to be folded so that they will fit within the O & M Manual.

12.) Chapter 12 - Electrical Drawings

a.) Chapter 12 shall contain:

(1.) A complete list and definition of the electrical symbols used in the electrical drawings.

(2.) A complete, clear and legible 11" x 17" set of "As-Built" BHS electrical drawings. Additionally, a searchable PDF copy of these drawings shall also be provided on media that is acceptable to the Owner and inserted into a sleeve pocket within this chapter. The As-built drawings shall contain as a minimum the following:

(a.) Detailed wiring connection drawing noting each control device, control station, motor, and all other controls devices, in block form with a detail of the actual "field wiring" numbers and configuration.

(b.) Detailed conduit routing diagram indicating size of conduit, size and number of conductors, junction boxes, control devices, motors, safety disconnect switches, motor control panels, and BHS PC-type workstation.

(c.) Detailed block diagram representing internal layout of components within each motor control panel, both internal as well as external layout of components related to workstation.

(d.) Schematic Wiring Diagram of each MCP, including outline and wiring diagram of all special devices. An additional approved 11" x 17" reduced copy shall be placed in the door pocket of the MCP.

(3.) The 11" x 17" drawings are to be folded so that they will fit within the O & M Manual.

13.) Chapter 13 - PLC Listings

a.) Include a complete, clear and legible set of "As-Built" BHS PLC listings. The listing shall include the following:

(1.) Complete set of PLC program ladder logic diagrams as well as PLC listings for the related system.

(2.) A complete Sequence of Operation shall be included on the schematic diagrams or the PLC ladder logic diagrams.

(3.) PLC ladder logic diagrams shall have detailed "right hand" margin descriptors clearly identifying the function of each device and its associated contact rung locations.

Copyright © 2018 by BNP Associates, Inc. (BNP)

(4.) Include a separate I/O list for each PLC or remote I/O in the panel. Identify I/O assignments with Equipment Item Numbers.

7. Draft O & M Manuals

   a. Submit one (1) set of a draft Operations and Maintenance Manual for review and approval to the Owner or their Representative prior to Start-up of the system(s).

8. Final O & M Manuals

   a. One (1) Set of the Final O & M Manuals shall be presented to the Owner in accordance with the submittal schedule. Timely submittal of the system's O & M Manual is absolutely essential to be completed and available prior to the use of the system.
   b. The O & M Manuals shall be updated by supplement to reflect any Field Changes, equipment changes due to warranty changes, and any other changes that were made during the Warranty Period of the System, so that all sets of manuals shall reflect "As-Built" information.
   c. A searchable PDF format copy of the O & M Manual shall also be provided to the Owner at no additional cost to the project.

J. Periodic Maintenance Inspection and Lubrication Chart

1. Submit a master chart or series of charts involving periodic maintenance of all equipment items in the system and defining, under equipment item subdivisions, the points and frequency of recommended periodic maintenance functions, including inspection, lubrication and replacement.
2. This chart need not detail the procedures involved with the periodic maintenance functions since such procedures will be found in the maintenance manual, but reference shall be made to specific sections or pages therein.

K. Training Program

1. Submit an operational and maintenance training program as specified in Part 3 of these Specifications.
2. The training program shall be submitted to the Owner or their Representative for review and approval prior to the start of System Testing and in accordance with the schedule of submissions.

L. Environmental Requirements

1. Submit any special environmental requirements above and beyond what is shown in these specifications that may be essential for correct equipment operation (e.g., MCP Touchscreen Terminals, computer hardware, VFDs, and any other items with special requirements).

M. List of Lubricants

1. Submit a complete list of lubricants to be used on the equipment components. This list shall be standardized on one supplier in order to minimize the number of different lubricants used.

N. Inspection, Functional Specification and Testing Program

1. Submit an Inspection, Functional Specification and Testing Program for the BHS to demonstrate compliance with all specified requirements. Prepare the inspection and test plans based on the information provided in this specification. The BHS Contractor’s test plan submittal shall include the tests that are outlined in Part 4 of this specification.
2. The Functional Specification and Test Program shall identify and demonstrate all System Control Functions relating to the operational, functional and system performance tests. The Functional Specification/Test Plan is to list each Control Station, and Control Device or component, and its related Control Function that is to be demonstrated/tested. Refer to the Acceptance and Testing Section of this specification for detail test plan content requirements.
3. The testing plan shall also include testing of all systems integrated with the BHS (for example, fire alarm and building access control security systems and other interfaced devices).
4. The Inspection, Functional Specification and Testing Program shall be submitted for the Owner or their Representative’s review and approval prior to the start of System Testing in accordance with

Copyright © 2018 by BNP Associates, Inc. (BNP)

Schedule of Submissions.

O. Test Reports

1. Submit a report after completion of the internal testing, debugging and system tests performed prior to Acceptance Testing summarizing the detailed results of the tests with associated third party reports (if any), to the Owner or their Representative (minimum of two (2) weeks) prior to requesting final acceptance testing by the Owner or their Representative.
2. In addition carry out a "dry test run" of Acceptance Tests prior to conducting such tests with the Owner or their Representative to ensure that tests conducted with the Owner or their Representative are successful.
3. Provide the Owner or their Representative, upon request; the results of all in-plant tests, with associated third party test reports (if any), conducted on assemblies or sub-assemblies of equipment or tests upon equipment of similar type to that, which are planned to be installed.

P. Certification of Installation Compliance

1. Submit certificates issued by Regulating Authorities (in compliance with work permits; electrical, mechanical, welding, Fire Marshall and other Authorities), that the equipment has been properly installed, meets all safety standards and is operating within the required accuracy.

Q. Certification of Test Compliance

1. Submit BHS Equipment Supplier's Certification that the system has been tested in compliance with the supplier's requirements for testing and has met all testing requirements.

R. Final Parts List

1. Provide a detailed listing and description of all individual system (subsystem) components with reference to layout and assembly drawings.
2. The listing of system parts shall include the following information:
    a. Name of part
    b. Complete description of part
    c. Each specific location that the listed part is used in the system(s).
    d. Total number of parts in system(s)
    e. Manufacturer of part
    f. Manufacturer's part number
    g. Source of supply
    h. Recommended quantity of spares per each item
    i. Price per unit
    j. Lead time or availability of part
    k. Complete list of manufacturers, with addresses, telephone numbers and point of contact.
    l. Manufacturer's catalog literature and specifications for all purchased parts.

S. System Power Requirements and MCP Sizes / Locations

1. Submit all the motor control panel (MCP) sizes / locations and related power requirements for the all subsystems of this project.
2. The power requirements shall indicate conveyor segment horsepower, and the total connected load of the new subsystems (horsepower and full load amps).
3. Clearly illustrate (in color) in plan view how the BHS will be powered in order to satisfy redundancy requirements.
4. The MCP sizes and locations in the submittal shall be coordinated with the housekeeping pad locations shown in the Structural drawings.

T. System Reliability Calculations

1. Submit system reliability calculations demonstrating compliance with the "System Reliability" requirements specified herein.

Copyright © 2018 by BNP Associates, Inc. (BNP)

U. Bi-Weekly Status Reports

1. The BHS Contractor's Project Manager shall submit a Bi-Weekly Status Report to the Owner or their Representative, which shall include schedule updates in accordance with the provisions of the contract terms. The Owner or their Representative shall have the right to change the time of submitting and the details of the report. The bi-weekly status reports shall cover, including but not limited to, the following information:

    a. Percentage of mechanical and electrical and controls/computer engineering completion, per subsystem.
    b. Percentage of fabrication completed.
    c. Equipment delivery schedule (month look ahead).
    d. Percentage of equipment installed complete:

        1.) Mechanical
        2.) Electrical
        3.) Controls
        4.) Computer

    e. Updated detailed Project Schedule.
    f. Task activities planned for the next two weeks.
    g. BHS Engineering Issues.
    h. Interface Issues including but not limited to the following:

        1.) Fire Alarm and Building Access Control Systems
        2.) MCP power supply
        3.) PC-type Workstation located in the Airport Safety Office, to include interface points to the Owner's Communications closets and associated switches/port assignments.

    i. Right of Way Issues.
    j. Brief description with status of accepted and proposed change orders with associated cost.
    k. Status of payments.
    l. Manning by trade.
    m. Percentage of testing completed.
    n. Any other issues.

V. Submittal Register/Log

1. Provide a log to the Owner or their Representative listing all required project submittals to include, at a minimum, the following information:

    a. Type of submittal.
    b. Submittal revision number. (The submittal revision number shall also be clearly identified within the submitted document as well.)
    c. The date in which the submittal is sent out for review.
    d. Company or individual the submittal is sent to.
    e. Date in which the submittal was returned after review has been completed.
    f. Review status.
    g. The log entries shall be maintained as current on no less than a weekly basis with submission to the Owner upon request.

W. System Installation, Construction and Commissioning Safety Program Manual

1. Submit a system installation, construction and commissioning safety procedure to be utilized for this project for the Owner or their Representative's review and approval.

X. Computer/Software/Hardware Inventory

1. Provide to the Owner or their Representative a detailed listing for each computer/PC to be submitted upon Conditional Acceptance.
2. Submit the listing (by computer) along with all program disks, manuals, manufacturers information, and the like information in an organized format (i.e.: binder with dividers or an acceptable format

Copyright © 2018 by BNP Associates, Inc. (BNP)

to the Owner) upon Conditional Acceptance.

3. It shall include in addition to the above, at a minimum, provide the following:

    a. Complete software inventory by computer, including all version numbers and dates.
    b. Complete hardware inventory by computer.
    c. Registration numbers, serial numbers.
    d. Computer emergency boot/recovery disks.

Y. Computer Log

1. Upon conditional acceptance it shall be the responsibility of the BHS Contractor to maintain a computer log. The purpose of the log is to keep track of any system computer problems/issues, which occur during the conditional acceptance period for trouble shooting/tracking purposes during its operational life.
2. The log shall be compiled in an electronic format acceptable to the Owner or their Representative and shall include, at a minimum, the following information:

    a. Date/Time of Occurrence
    b. Type of Issue(s) (i.e. user interface issue, graphic monitoring issue, reporting issue, or the like)
    c. Description of the issue.
    d. Name/shift of individual that discovered the problem.
    e. Resolution to the problem on site.
    f. Effect on the system.
    g. BHS Contractor Individual Contacted for support and troubleshooting.
    h. Programs, files affected by the resolution to the issue.

3. As a minimum, the computer log should be issued to the Owner or their Representative on a weekly basis, or as requested by the Owner or their Representative.

Z. Project Management Team and Staffing Plan

1. Submit to the Owner or their representative for review and approval, the following listing of key personnel with resumes and qualifications that shall be working on the BHS project:

    a. Project Manager
    b. On-Site Field Supervisor(s)
    c. Professional Engineer(s)
    d. Safety Manager
    e. Configuration Control/Schedule Manager(s)
    f. Quality Assurance / Quality Control On-Site Trades Coordinator(s)
    g. Project Manager(s) – Electrical and Control Systems Engineering
    h. Project Manager(s) – Mechanical Engineering
    i. Project Manager(s) – Computer Systems Engineering
    j. Instructors/training personnel (in addition, provide instructors professional qualifications)

2. Include on-site and off-site participating personnel and the percent of anticipated participation on this project. The Owner reserves the right to approve or reject key personnel from the list.
3. The BHS Project Manager and on-site Superintendent(s) shall not be changed without the Owner's written approval.
4. Submit a staffing plan broken out by trade (e.g., number of millwrights, mechanical/electrical technicians and control/computer programmers) for this project for review and approval by the Owner or their Representative.
5. The BHS Contractor, individuals or entities constituting the BHS Contractor and the officers or directors of the BHS Contractor or entities or key members of the Project Management Team shall have records of past performance sufficient to assure the Owner that they have the experience, competence and integrity to successfully complete a project of this magnitude.

1.6 BHS CONTRACTOR'S QUALITY ASSURANCE GENERAL REQUIREMENTS

Copyright © 2018 by BNP Associates, Inc. (BNP)

A. General

1. This section to be used in conjunction with Division 01 and 02 specifications. Where conflicts occur, the more stringent of the two shall apply.

B. Laws, Codes, Rules and Regulations

1. Comply with all applicable Local, State and Federal laws, rules and regulations pertaining to the following:

   a. Installations, testing, and inspections, including but not limited to the Federal Occupational Safety and Health Act and the Construction Safety Act.
   b. Protection of the public during installations, including but not limited to, requirements for safety of operations, noise control, removal and disposal of waste materials, control of dust, dirt, pollutants, flammable materials, explosive materials, corrosive substances, and protection against fire.

C. BHS Contractor Qualifications

1. Authenticate a minimum of five (5) years of demonstrable experience as a turnkey Baggage Handling System Contractor, equipment manufacturer and supplier of baggage handling equipment, and no less than two (2) completed projects that each meet all of the following criteria:

   a. BHS project value of no less than $3,000,000 USD (BHS portion only).
   b. Provided system with controlling PLC systems as well as maintenance status and graphic fault annunciation for the baggage system.

2. All bidders shall include with their bid, verification that they meet this criteria, a listing and description of previous projects meeting this criteria (no less than two), and contact information for the Owner's use in verification.

   a. If proposing to team with an approved controls subcontractor (other than the bidder's own company), the qualifying projects must have been performed with the same team being proposed (i.e., provide two qualifying projects that utilized the same prime Contractor and controls subcontractor) or both companies must independently meet all of the requirements (i.e., provide two qualifying projects each).

D. BHS Project Configuration Management Plan

1. Maintain strict configuration control of all aspects of the design, construction, fabrication and installation of the BHS and related programming changes. Submit a Configuration Management Plan for the Owner or their Representative's review and approval and carry out all aspects of this plan during the course of this project.
2. Establish a system, identify, organize and track all documents developed as part of the BHS Contract Work throughout the duration of the project. Serialize all correspondence and transmittals and establish a logging system for incoming/outgoing correspondence showing action requirements and action taken. Drawings, specifications, subcontract documents, reports, estimates, studies, reviews, MCP Touchscreen Terminals, BHS PC-type Computer Terminal Workstation and PLC system programming changes, and computer files shall be tracked by a logging system.
3. Provide each computer and PLC system under this project with a software solution that shall automatically audit/manage the configuration and change management of its respective operating software applications.
4. Tracking logs for correspondence and documents shall be provided when requested by the Owner or their Representative. Establish a single source for transmitting and receiving documents and correspondence. Material from subcontractors shall be consolidated and submitted to the Owner or their Representative by the BHS Contractor.
5. Logs for correspondence and document control shall be provided to the Owner or their Representative on electronic media and in reproducible hard copy for use in the Owner's document control system.
6. Once configuration for an element of the BHS is established (for example, at Design Reviews or during acceptance testing), the configuration of all such elements shall not be changed by the BHS

Copyright © 2018 by BNP Associates, Inc. (BNP)

Contractor without proper approval as provided for in the Configuration Management Plan. Once configuration changes are approved, formal Change Order Documentation shall be circulated in accordance with a distribution list (which shall include the Owner or their Representative) developed for that purpose.

7. Ensure that at conditional acceptance of the BHS the above referenced provided computer and PLC system software solution to automatically manage configuration and change management for all operating software applications, is carried out and executed consistent with the following minimum functions:

    a. Monitor critical computer services
    b. Log system events across concurrent processes
    c. Audit and log changes made to the running processes
    d. Verify, backup and recovery programs and system files
    e. Secure access to editing and monitoring functions
    f. Provide file management for all system components
    g. Manage and secure product access

8. The audit function shall track every change made to the BHS and its operating programs, including detecting who, where and when changes were made. The archive file management function shall manage all revisions carried out to the system, as files are modified, revisions shall also be stored and be accessible for future use.
9. Submit to the Owner or their Representative for formal review and approval details of every proposed change to any of the operating programs (PLC and computer systems) after conditional acceptance of the BHS, or submit proposed changes for review and approval as requested as part of the acceptance testing procedures.

E. Non-Standard Equipment

1. Any proposed equipment which is appreciably different from items previously fabricated or which has not displayed satisfactory performance in a similar environment for at least one year (for a minimum of 18 hours per day, 7 days per week), shall be so noted in the proposal. As a reference, any of the following components that do not meet the requirements listed in the previous sentence shall be considered non-standard:

    a. 45° Merge Conveyors
    b. Power Turns

2. Prior to the start of fabrication, a prototype of the new item shall be built, and test data shall be presented showing that the item has successfully performed the equivalent of one full year of operation. The Owner or their Representative shall be invited to witness the test and review the test data at no additional cost to the project.
3. The testing requirements and demonstration shall identify such requirements as follows:

    a. Number of hours of run time
    b. Number of test cycles
    c. Throughput Processing rates
    d. Mean time between failures
    e. Repair time, serviceability

4. The Owner or their Representative must approve the design before the final design and fabrication, provided that the BHS is produced by a firm with at least 3 years of experience in manufacturing and installing such systems comparable to that required under this contract. The Owner or their Representative must approve the use of firms with less than 3 years' experience.
5. In lieu of developing a prototype, arrangements may be made for the Owner or their Representative to inspect an existing component in operation elsewhere at an airport at no additional cost to the project.

F. Pre-Installation Meeting

1. Prior to the start of the installation, attend meetings on site as required or requested by the Owner or their Representative. The Owner or their Representative will schedule the Pre-Installation

Copyright © 2018 by BNP Associates, Inc. (BNP)

meetings, for the purpose of coordinating the on-site installation with ongoing airport operations.

2. Submit at the initial pre-installation meeting to the Owner or their Representative the following:

   a. Safety Program Manual
   b. Drug Policy Manual
   c. Submittal Schedule
   d. Project Organization Chart to include all Sub Contractors
   e. Principal suppliers to include long lead items and planned procurement dates
   f. Insurance enrollment forms
   g. Quality Control Manual
   h. Configuration Management Plan
   i. Details of QA/QC Program
   j. Diversity Program
   k. Updated Master Schedule
   l. Plans for coordination and notification for utility work.
   m. Plans for coordination with the work of other Contractors and procedures for sharing access to work site.
   n. Schedules for deliveries of major equipment.

G. Pre-Demolition Meeting

1. Prior to the start of any demolition, attend meetings on-site as required or requested by the Owner or their Representative. At a minimum, each BHS Construction Phase shall include one (1) pre-demolition meeting. Pre-demolition meetings shall be scheduled for each BHS phase of construction (on phase by phase basis). The Owner or their Representative shall schedule the Pre-Demolition meetings for the purpose of coordinating the on-site removal of the BHS equipment for each BHS phase with ongoing airport operations.

1.7 PROJECT CONDITIONS

A. General

1. The Owner or their Representative does not guarantee the accuracy or the completeness of the information relating to utility services, facilities, or structures that may be shown on the drawings or encountered in the work. Any inaccuracy or omission in such information shall not relieve the responsibility to protect such existing features from damage or unscheduled interruption of operations and services.
2. Prior to commencing the work in the general vicinity of an existing system, utility service or facility, notify the Owner or their Representative 72 hours in advance and obtain approval before proceeding with the work.
3. Failure to give the 72-hour notice shall be cause for the Owner or their Representative to suspend the BHS Contractor's operations in the general vicinity of the System, utility service or facility.
4. Should damage to or unscheduled interruption of airline operations, utility service or airline facility occur by accident or otherwise, the BHS Contractor shall notify the Owner or their Representative and take all reasonable measures to prevent further damage or interruption of service. In such events, cooperate with the utility service, Airport Owner until such damage has been repaired and service restored to the complete satisfaction of the utility service or the Airport Owner.
5. Coordinate all building modifications performed by any trade to accommodate the installation of the BHS.

B. Installation Conditions

1. This BHS is to be installed within the existing Terminal, which includes the existing facility space at the outbound baggage make-up area and the Terminal Expansion, working simultaneously with other trades.
2. The BHS Contractor shall visit the site to familiarize himself with the site conditions and to understand local conditions that may affect the project before submitting his bid proposal. Where possible the BHS Contractor shall familiarize himself on the availability of temporary access,

Copyright © 2018 by BNP Associates, Inc. (BNP)

temporary lighting and power, telephone services, storage facilities, water supply, waste disposal facilities, labor supply, weather conditions, parking of vehicles, loading and unloading of materials, and equipment. In particular, take into account in his bid proposal any effect that any adjacent construction, operations and maintenance works may have on the BHS installation. The BHS Contractor shall ascertain for himself and allow in his bid proposal for all necessary precaution and for any difficulties that may arise in the execution of the BHS Contract. No claims whatsoever arising out of the site constraints, difficulties of access, temporary services and facilities, labor, and any other charges will be entertained by the Owner.

C. BHS Phased Implementation

1. Comply with the Phased Implementation General Requirements and outlined phasing summary specified herein, in compliance with the overall project schedule, and applicable requirements of Division 01, Section 011000 (Summary).

D. Ramp Area Proximity

1. The portions of the construction/installation associated with this project shall take place immediately adjacent to an active aircraft ramp area and airline operations area.

E. Lay-down Area Restrictions

1. Lay-down and shake out areas may be limited to the confines of the immediate building. All Lay-Down areas shall be designated and approved by the Owner or their Representative.
2. Reference the Civil Drawings for BHS Contractor Lay-down area considerations and coordinate usage with the Owner or their Representative.

F. Restoration of Service Costs

1. Incur all restoration of service costs due to the negligent or accidental damage of any airport utility service or facility. The Owner reserves the right to deduct such costs from any monies due, or which may become due, from the BHS Contractor, or its surety.

G. BHS Rights-of-Way

1. It is acknowledged by all parties that the BHS Contractor has first priorities to the right-of-ways available and/as provided by the appropriate discipline under this contract. Cooperate with other contractors for coordination of all building right-of-ways performed by other trades to accommodate the installation of the BHS. Considering the size and magnitude of the BHS scope, the BHS conveyor equipment and associated main conduit/wireway runs (e.g., between the facility power supply sources and BHS Motor Control Panels) shall have first priority to the available right-of-ways within the facility space and as provided by the demolition and clearing of other systems. Coordinate the BHS conveyor equipment and associated main conduit/wireway right-of-ways with all MEP systems right-of-ways that will be installed within the facility to accommodate the specified system installations.
2. Preserve all right-of-ways for deferred BHS equipment depicted on the Contract Drawings.

1.8 PROTECTION OF THE WORK

A. General

1. Make such explorations and probes as are necessary to ascertain any required protective measures before proceeding with installation. Give particular attention to equipment supports and bracing requirements so as to prevent any damage to BHS equipment.
2. Provide, erect and maintain catch catwalks, dust partitions, lights, barriers, warning signs and other items as required for proper protection of operating personnel, the public, occupants of building, and workmen engaged in installation and/or adjacent construction. Comply with the requirements and restrictions of the Contract Drawings.
3. Do not store or place materials in passageways, stairs or other means of egress. Do not close or

Copyright © 2018 by BNP Associates, Inc. (BNP)

obstruct catwalks, walkways, passageways, stairways, streets, walks, terminals, runways, rights-of-way, or other occupied or used facilities without written permission from the Owner or their Representative. Conduct operations with minimum traffic interference.

4. Provide and maintain temporary protection of the new work being done, connections made, materials handled, and equipment moved.
5. Utilize suitable coverings to protect existing facilities. Be responsible for any damage to the facilities or other contents by reason of the insufficiency of protection provided. Promptly repair damage caused to adjacent facilities and restore as new.
6. Repair any damage to work in place. This includes repair of new and existing fireproofing materials removed to allow the installation of BHS structural attachment supports, header steel, and any other BHS equipment.

1.9 SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS

A. General

1. All equipment shall be in strict accordance with the specifications described herein. It should be noted and stressed that the system shall be engineered, fabricated and installed with the objective of being of rugged, heavy duty, impact resistant equipment capable of withstanding the abuse and exposure to damage experienced in an air transportation baggage handling facility. Other key factors to be considered in the development of the system and its elements shall be simplicity, reliability, maintainability, and safety.
2. The BHS Contractor is deemed to have studied the system design and requirements presented in the drawings and specification respectively and accepted the design and requirements as suitable and appropriate to safely accomplish the functions and processes described herein. Identify in the bid submission any design aspect or specification requirement that is believed to be inappropriate or inadequate and shall propose alternate solutions to alleviate the perceived problem but, in all cases, include in the bid submittal pricing for the base system presented in the drawings. Any alternate designs developed by the BHS Contractor must meet or exceed the design criteria as listed in the specifications.
3. Consideration shall be given to the design, fabrication and installation of all projections, welds, and transfer points between conveyor segments and conveyor items to eliminate damage to the various types of baggage processed.
4. The system and subsystem layout configuration and item/component functional requirements are specifically described on the contract drawings. However, alternate solutions, may be proposed on an optional bid cost basis for consideration by the Owner. Any alternate designs developed by the BHS Contractor shall meet or exceed the design criteria as listed in these specifications.

B. Material and Equipment Approvals

1. Where manufacturer's name, brand or trademark is specified, it has been selected to establish a standard of quality for the materials, components or equipment required. Materials, components or equipment of different manufacture considered to be equal to the materials, components or equipment specified will receive full consideration and shall be subject to approval by the Owner or their Representative before being incorporated into the work. The contract price shall in all instances be based only upon materials, components or equipment specified. A list of material, component or equipment suppliers shall be submitted to the Owner or their Representative for approval. Provide a listing of sources where any material, component or equipment, for which a substitution approval is being requested, can be obtained.
2. Submit all engineering data, engineering/shop drawings, literature, test results, calculations, and any other requested information, for review of substituted material, components or equipment. The BHS Contractor shall pay for any redesign necessary to accommodate an “approved equal”.

C. Request for Deviations from Drawings or Specifications

1. Requests for deviations from drawing or specification requirements shall comply with Division 01, Section 012500 (Substitution Procedures) and may be approved at the discretion of the Owner or their Representative to permit use of standards inherent in the equipment when it has been

Copyright © 2018 by BNP Associates, Inc. (BNP)

determined by the Owner or their Representative that such deviations will in no way be detrimental to the conveyor equipment, the safety, operation and maintenance of the specified system, system design, system reliability and its associated inventory of spare parts.

2. Any materials, components or equipment submitted for substitution for this BHS shall be previously proven under the loads as specified in Part 1 of this Specification in an operational or test equivalent environment for a minimum of 1 year, 18 hours per day, 7 days per week.

D. Baggage Conveyors

1. Conveyor Loads

a. Design the conveyors and their supports using the following loading criteria:

1.) The total cumulative live and dead static load imposed on the building (composed of the conveyor components, supports and baggage) used for designing structural elements, rollers and pulleys shall be 100 pounds per linear foot except for merges in which case it shall be 150 pounds per linear foot.

2.) All conveyor equipment shall be capable of supporting a single concentrated static load of 250 pounds.

3.) The live dynamic load to be utilized for sizing drives, belts, bearings, and other components, shall be 60 pounds per linear foot for load, unload and accumulating conveyors operating up to a speed of 120 feet per minute. For all other conveyors (e.g. transport) it shall be 40 pounds per linear foot operating at a conveyor speed of 90 feet per minute and a throughput of 25 bags per minute adjusted proportional to speed and throughput. As an example, an outbound transport line traveling at 150 feet per minute and rated at 25 bags per minute would have to be rated at 24 pounds per linear foot for load testing. The following formula shall be utilized to determine the test ballast for the purpose of load testing and preparation of related test plans during the BHS acceptance period:

a.) Formula: 40 lbs. per Linear Foot x (90 FPM / actual conveyor speed) x (throughput rate / 25 bags/min) = xx lbs. per linear feet

2. Conveyor Dimensions

a. All equipment shall be of U.S dimensions.

b. Unless otherwise specified on drawings, construct conveyors to the following dimensions:

Conveyor Type	Overall Width	Between Guide Width	Belt Width
Standard Conveyors and Power Turns	42"	39"	36"

Note 1: Standard Power Turn Inside Radius shall be 4' 0".

3. Conveyor Side Guard Heights

a. Refer to Part 2 of this specification for side guard heights.

4. Conveyor Speeds

a. Unless otherwise specified, conveyors speeds shall be selected by the following criteria.

Type/Location	Speed (Feet/Min)
Public Area and Non-Public Area Load Conveyors	90
Transport to Slope Pallet Make-up Device and to Non-Public Area Runout Conveyor	120 to 180*
Non-Public Area Runout Conveyor	90

*As required to achieve specified throughput rate process times and as required by a system subcomponent manufacturer (e.g. for 45° Merge Controls Functionality).

Copyright © 2018 by BNP Associates, Inc. (BNP)

5. Speed Changes

   a. Make speed changes between adjacent conveyors to increase or decrease a maximum speed (nominally 30 feet per minute) so as not to adversely affect baggage spacing.
   b. Feed conveyor speed onto the related make-up device will not be greater than 120 feet per minute, unless otherwise specified.

E. System Throughput Processing Rates

1. Unless otherwise specified, System Throughput Processing Rate shall be:

Conveyor Type	Minimum Processing Rate
Ticket Counter Lines and Clear Bag Runout Conveyors (Each Subsystem)	25 bags per minute
Outbound Transport Conveyors with More Than One Input	30 bags per minute

F. Baggage Characteristics

1. Design the BHS to convey standard airline baggage tubs and to process baggage having the following characteristics:
2. Size of Single Piece:

Conveyor Type	Length	Width	Height
Standard Conveyor Maximum	54"	33"	34"
Standard Conveyor Minimum	12"	12"	4"

Note 1: Average bag length for the purpose of rate testing shall be 28". The system shall be capable of accommodating 42" bag lengths without compromising the baggage-processing rate. The standard outbound conveyors shall also be capable of accommodating 54" bag lengths at lower processing rates. The specified dimensions for the standard baggage sizes are intended to provide the maximum individual dimension for each of the three magnitudes indicated, and not to exceed the maximum baggage weight. For any given length or width dimension, the baggage conveying surface area must not exceed 12 ft^2. For example:

(1.) Given a 54" max length dimension, the width must not exceed 32" wide.
(2.) Given a 33" max width dimension, the length must not exceed 52" long.

3. Weight of Single Piece

Conveyor Type	Weight
Standard Conveyor Maximum	120 lbs.
Standard Conveyor Minimum	3 lbs.

4. Shape

   a. At least one flat conveyable surface. Baggage meeting the above size limitation but lacking a flat conveyable surface (such as baby carriages, round duffle bags, and the like) shall be processed in standard airline tubs.
   b. Design system to accommodate 90% of the baggage normally encountered with or without the use of standard airline tubs, including but not limited to, golf bags.

5. Surface Material

   a. Complete spectrum of package materials found in air transport baggage, including paper, cardboard, cloth/canvas, plastic, leather, wood, and metals in the following conditions:

      1.) Dry to Wet

Copyright © 2018 by BNP Associates, Inc. (BNP)

2.) With/Without:

a.) Paper/cloth/plastic tape/wrapping
b.) Plastic/steel bands
c.) Fiber cord
d.) Twine
e.) Wheels
f.) Straps

G. Physical Constraints

1. Design the BHS to accommodate the following physical constraints imposed on the System by either operational or facility considerations:

a. All conveyors, supports and related components (unless shown as floor supported, within the confines of protective guard rails, or within a confined and protected space) shall have a minimum underside clearance of 8'-0" from the bottom of the support structure to the floor, unless otherwise specifically noted on the Contract Drawings.

b. Minimum clearance on all conveyors from the top of the conveyor belt to the underside of any obstruction shall be 36 inches, unless otherwise specifically noted on the Contract Drawings. Ensure through proper coordination with other Contractors on site and in the BHS design that these conditions are not compromised to a lesser dimension than that stated in the contract documents. Additionally, lateral clearances to building elements shall be 12" (minimum) along a wall and 6" (minimum) along columns, hand/guard rails or other architectural elements such as bollards or the like, unless otherwise specifically noted on the contract documents

c. All inclined and declined conveyors shall have the following:

1.) A maximum slope of 18° for conveyors unless otherwise indicated on the contract drawings.
2.) In all cases, where space permits a shallower angle, the BHS Contractor shall minimize the slope utilizing the least possible incline/decline angle to achieve the proper elevation change.

d. All inclined or declined spiral power turns shall have a maximum elevation change of 1 foot in rise or fall per 45° of turn, unless otherwise indicated on the contract drawings.

e. If any of these design criteria cannot be maintained, notify the Owner or their Representative in writing for resolution.

H. Vibration

1. Provide shaft mounted components (pulleys, sprockets, and other shaft mounted components) and other components subjected to vibration with some means of preventing loosening of the component such as snap rings, cotter pins, or other methods approved by the Owner or their Representative.
2. Mount all conveyors on vibration isolation pads or hangars except those components supported from a ground floor slab or other structural floor whose characteristics prevent vibration from the conveyors from being transmitted to adjacent structure(s) or perceived surrounding area.
3. Mount all conveyor components supported from structural elements adjoining public and office space on vibration isolation pads or hangers to eliminate perceivable vibration from being transmitted to the building.
4. Conveyors and components that are header steel surface mounted to building elements shall not transmit any vibration. Such items shall be fitted with vibration isolators to eliminate vibration at no cost to the Project.
5. Vibration isolation devices shall be determined based on individual support loads, vibration frequency and vibration amplitude so that appropriate vibration isolation is proved.
6. Provide vibration isolation devices that prevent perceivable vibration from being transmitted to the surrounding building structure.
7. Ensure that all National, State, and Local codes for seismic requirements are met for the project.

I. Balancing

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. Dynamically balance all rollers and pulleys.

J. Service Conditions

1. Design each element to operate satisfactorily in its respective environment as follows:

a. Mechanical - Indoor (Bagroom Environment)

1.) Temperature: 32° to 120° F (0° to 48°C)
2.) Relative Humidity: 5% to 99% Non-condensing
3.) Protected from direct exposure to weather

b. Electrical/Electronic Equipment Inside Control Panels

1.) Temperature: 32° to 140° F (0° to 60°C)
2.) Relative Humidity: 5% to 99% Non-condensing

c. Electrical/Electronic Equipment - Indoor (Bagroom Environment)

1.) Temperature: 32° to 120° F (0° to 48°C)
2.) Relative Humidity: 5% to 99% Non-condensing
3.) Protected from direct exposure to weather

2. Provide and clearly identify any special environmental requirements more stringent than what is shown in these specifications that may be essential for correct equipment operation (e.g., computer hardware and any other components with special environmental requirements).

K. System Safety

1. Design, manufacture, supply, install and construct the BHS in accordance with all of the requirements in the Contract Documents, and shall meet or exceed all applicable laws rules, orders, regulations and codes. In this regard, the BHS Contractor shall be responsible throughout this Contract to bring to the attention of the Owner or their Representative in writing any changes in such laws, rules, orders, regulations and codes and any condition(s), whether caused by its design or any BHS Contract requirements, which the BHS Contractor believes may result in or has resulted in an unsafe condition(s). Rectify at the BHS Contractor's own cost any such condition(s) resulting from its design and not directly as a result of any Contract requirement(s). Where the Owner and the BHS Contractor mutually determine that such condition(s) is directly a result of any Contract requirement(s) or any changes in laws, rules, orders, regulations and codes, then the Owner and the BHS Contractor shall seek a mutual resolution of the condition(s) to be effected by a Change to the Contract.
2. Utilize control methods and techniques, circuitry, mechanical and electrical equipment and operating/maintenance procedures to provide maximum safety for operation and maintenance personnel and to minimize potential damage to the equipment and to the baggage being processed. Incorporate fail-safe techniques to prevent the occurrence of unsafe conditions, which could result from an equipment failure or improper implementation of the operating procedures.
3. As employed herein, the failsafe principle shall be interpreted as follows:

a. In the event an equipment failure or external influence such as improper operation, high temperature, power failure, or other adverse condition affects the proper function of a system or element involved with the safety of life or health, said system or element shall revert to a state known to be safe to all personnel interfacing with the equipment.

4. Ensure that all provided and installed equipment meets all applicable local, state and federal safety codes, including applicable OSHA standards and requirements, for baggage handling systems/conveyors and industrial machinery environments.

L. Personnel Safety

1. The operation of the system shall be convenient and safe to use, and control functions to be performed shall be simple to minimize possible errors. The BHS Contractor shall provide convenient means for emergency system shutdown.
2. Provide adequate means for ensuring the safety of all personnel who have access to the system in

Copyright © 2018 by BNP Associates, Inc. (BNP)

the system design.

3. Provide sufficient safety signage throughout the system.
4. Provide lockable devices such as disconnect switches and lockouts to prevent the accidental activation of those portions of the system shut down for maintenance. These devices shall be located in all areas.
5. Provide equipment and component guards on all drives for conveyors. House all moving parts in personnel areas with guards (such as bearings, return rollers, and return conveyor belts).
6. Provide sufficient work space in all limited access areas
7. Provide audible and visual warning signals along all areas of the system to make apparent any potential hazards to the public, operating and maintenance personnel resulting from moving or about-to-start equipment.
8. Provide protection from falling objects in work areas or aisles located beneath overhead portions of the system with gap pans or netting.
9. Locate conduits and all other electrical components where they shall not be subject to damage by maintenance or operational personnel.
10. Coordinate access provisions for operators so as to minimize obstructions. Locations of control stations and electrical boxes shall be coordinated to support unrestricted access by staff. The provisions of the conveyor supports, drive configurations, personnel guarding, and side guards shall allow for maximum operator accessibility.

M. Noise Levels

1. Design, fabricate and install the BHS to limit combined equipment and controlled ambient noise levels to the following allowable maximum requirements. However, the BHS equipment shall not increase the ambient noise level by more than 15 dB (A). In any case, ambient noise levels for the BHS equipment shall not exceed OSHA standards.

Noise Level	Ambient
65 dB (A)	In public areas or ceiling above public areas and offices (measured at a number of positions normally occupied by passengers, public and staff) and in the TSA work areas.
75 dB (A)	In bagroom and all other associated non-public areas or unoccupied areas.

2. Unless otherwise specified the measurements shall be taken at a maximum distance of 5 feet vertically and 5 feet horizontally from noise producing components.
3. The noise level measurement shall be accomplished utilizing an integrating sound level meter supplied by the BHS Contractor. A qualified person employed by the BHS Contractor shall accomplish measurements and evaluation. The BHS Contractor shall provide a certificate of calibration to the Owner or their Representative.
4. The noise level shall be the Equivalent Continuous Sound Pressure Level measured over a period of one minute or more at each location. In addition, to the overall A-weighted noise level, the Equivalent Continuous Sound Pressure Level shall be measured for each octave frequency band from 125 Hz to 4000 Hz.
5. Conveyor noise shall not be unduly impulsive. Observing the difference, between the measured Equivalent Continuous Sound Pressure Level and the instantaneous sound pressure level, shall test the impulsiveness of the noise. A component shall be considered unduly impulsive if the differences exceed 3 dB (A).
6. Conveyor noise shall not be unduly tonal. Tonality shall be determined by observing the difference in level between any A-weighted octave band and each of its adjacent A-weighted octave bands. The sum of the differences shall not exceed 6 dB (A). All octave bands from 125 Hz to 4000 Hz shall comply with this requirement.
7. Every conveyor component shall be tested. The components shall be tested at full design speed under load conditions.
8. Noise level measurements shall be taken during non-operational hours to ensure passenger

Copyright © 2018 by BNP Associates, Inc. (BNP)

conversations or movements do not unduly increase the ambient noise levels in public areas.

9. Measurements shall be taken during a time when the ambient noise levels are at least 6 dB (A) below the conveyor noise level. The ambient noise level shall be determined both before and after the measurement of the components. The ambient noise level shall be determined as follows:

    a. The BHS equipment shall be turned off.
    b. All other equipment (i.e., air conditioning and heating equipment) shall be on and outside noise sources (from aircraft and mobile ground equipment) shall be as normal.
    c. Noise level readings shall be taken throughout a zone 5 ft. vertically and 5 ft. horizontally from the BHS equipment using an integrated sound level meter set to the A weighted network.
    d. After the ambient noise level has been determined, the BHS equipment shall be turned on and the total noise level shall be measured at the same points throughout the zone that the ambient levels were measured.

10. The BHS Contractor shall provide a written report to the Owner or their Representative detailing the results of the noise level measurements.

N. Radio Frequency Interference/ Electro Magnetic Interference (RFI/EMI)

1. Ensure by design and shielding that system equipment shall not create electromagnetic emissions, which can, in any way, cause interference with communications within the airport or between the airport and aircraft or ground support vehicles.
2. Choose all electrical and electronic equipment (including computer and related equipment) to operate without malfunction in the presence of normal electromagnetic emissions generated by other equipment normally installed or used at the airport including but not limited to the aircraft communications bands, high-power radar systems, various electrical motors and controls, power tools, welding equipment, automotive vehicles, ground power units and air handling units. Provide isolation transformers and line suppression units, if required.
3. Radio frequencies, if used for communications or information transmission within the systems, shall be applied for to the relevant Airport and Government Authorities for their designation and assignment.

O. Maintainability, Life & Reliability

1. The requirements set forth in this section are minimum requirements and do not relieve the obligation to provide a system in which all required maintenance tasks can be readily performed.
2. Design all components so they can be easily disconnected and removed from the equipment without the necessity for extensive disassembly. Design the components for removal and replacement by two (2) staff in a period not to exceed two (2) hours. Be prepared to demonstrate that any maintenance task, not so listed, can be accomplished as described above. Correct any installation, without charge, as required to accomplish this demonstration.
3. Design the system so that equipment components requiring inspection and servicing are readily accessible. Provide suitable doors for this purpose. Where necessary, provide access holes in frames or guards but keep them to a minimum number and size, and ensure that they do not create protrusions or discontinuities detrimental to the baggage being conveyed.
4. Design equipment to facilitate maintenance functions in preference to ease of fabrication.
5. Design equipment such that, whenever possible, assemblies shall not require dismantling in order to troubleshoot, repair or replace assemblies or components of assemblies involved in such servicing procedures.
6. Affix cover plate attachment hardware to, or hold captive in, the cover plate assemblies.
7. Provide all electric assemblies, panels, or boxes with the appropriate schematic, enclosed in a clear-faced envelope affixed in a location visible to personnel while servicing such items.
8. Provide one set of special test instruments and tools for each group of equipment items requiring such special test instruments and tools. These shall be provided in a metal toolbox with identification of the equipment for which the tools shall be used.
9. Provide a device for measuring conveyor speed and shaft/pulley rotational speed prior to commencement of Acceptance Testing for use by the Owner or their Representative, during the Acceptance Testing period.

Copyright © 2018 by BNP Associates, Inc. (BNP)

10. Provide fixed or liftable ladders, service catwalks, lifting lugs or other applicable provisions to ensure easy access to components requiring servicing, either as shown on the specification drawings or as required to assure a safe and efficient system for all personnel who operate, maintain or have access to it.

P. Standard/Interchangeable Components

1. Minimize the number of different types and makes of components used in the BHS to simplify spare part inventory.
2. Design all equipment and components to definite standard dimensions, tolerances, and clearances to provide maximum inter-changeability.
3. Provide like types of equipment from the same manufacturer wherever practicable.

Q. Lifespan

1. Provide equipment components and items for a system equipment life of a minimum of 15 years and an operating duty cycle of 18 hours a day, 365 days per year. This provision is a design objective, not a warranty.
2. It is understood that PC based computer equipment may not have the identical hardware available for the full 15 year period (PLC equipment does not fall under this category).

R. System Reliability

1. Reliability requirements of the total BHS shall be measured in terms of "System Availability" (As).
2. Failure

a. A failure is defined as any malfunction of a System component, assembly, or subassembly which stops normal operations. A failure shall be charged against only the one subsystem, which causes that failure. The following shall not be classified as failures:

1.) Malfunctions caused by a failure on the Owner's part (after system acceptance) to properly maintain and operate the System in accordance with recommended procedures.
2.) Malfunctions due to causes outside the System such as but not limited to sabotage or general power outage.
3.) Malfunctions due to baggage jams not caused by failure of a system component, assembly or subassembly unless it is a defective part, a poor installation, or a failure of a component or subassembly to perform its intended function.
4.) Incipient failures, which are detected and repaired without affecting normal operation of the System.

3. Sub-System Availability (As)

a. Sub-System Availability (As) shall be defined by the following equation:

$$A_s = \frac{(ST - RT)}{ST}$$

ST = Scheduled Operating Time: The scheduled time that the BHS is available for baggage processing (normally 18 hours per day).

RT = Repair Time: The interval of time between initiation of repairs due to a failure and return of the BHS to operation.

b. Each subsystem of the BHS shall have an availability of not less than 0.995 (99.5%) to be calculated on a monthly basis. However, the maximum allowable downtime in a single operating day shall be no more than 15 minutes on one subsystem; additionally, the accumulative downtime for all subsystems shall not exceed 20 minutes.

c. The time taken to clear a bag jam that was proven to have been the result of a bag being incorrectly introduced into the system (as reported by maintenance/operations/ramp (e.g., bags on wheels, straps not removed, for example, item that should have been in a tub) shall not be counted against the subsystem availability.

Copyright © 2018 by BNP Associates, Inc. (BNP)

d. No more than one failure per month of a computer, PLC and any other control equipment shall be acceptable.

e. All computer and control systems shall have an availability of not less than 0.999 (99.9%) to be calculated on a monthly basis. However, the maximum allowable downtime in a single operating day shall be no more than 2 minutes for a single event. The maximum downtime where a PLC (Primary and Secondary) fail shall be 10 minutes in a year. System availability shall be demonstrated and monitored during system acceptance testing and shall be proven (through operational reports) that it is maintained during the one-month operational period prior to system final acceptance.

S. Parts Availability

1. Maintain, for immediate delivery, an adequate inventory of any required spare replacement parts (especially long lead time items) that may be required for routine maintenance of the system, which are not readily available in the marketplace (e.g. custom manufactured equipment/components). Ensure that critical spare and replacement parts required by the system are made available for a minimum of a fifteen (15) year operational period through the availability of shop and as-built drawings and through the availability of the actual parts. Additionally, ensure the availability of custom or "special" components.
2. If the BHS Contractor fails to make such parts available during the fifteen (15) year operation period or should pricing become unreasonably high on a competitive basis, the Owner has the right to permit the use of the project drawings, at their discretion, for fabricating such parts, or having such parts fabricated so as to maintain the specified system.

1.10 STANDARDS AND CONSTRUCTION CODES

A. General

1. The design and subsequent installation shall provide adequate safety factors and shall conform to all current standards and codes of the USA, the City of Wilmington, New Hanover County, and the State of North Carolina, whichever is more stringent.

B. Construction Codes

1. In the event no specific local codes or standards can be identified, the BHS Contractor shall comply with the most recent version, applicable provisions and recommendations of the following:

a. American Welding Society (AWS)

1.)	D-1.1	Welder Qualifications
2.)	AWS-C1.1	Recommended Practice for Resistance Welding in Building Construction
3.)	AWS-A2.0	Standard Welding Symbols
4.)	D-1-0	Standard welding practice in building construction

b. American Gear Manufacturers Association Standards (AGMA)

1.)	6009-A00	Practice for Gear Motors
2.)	6035-A02	Practice for Worm Gear Motors

c. American National Standards Institute (ANSI)

1.)	A-1264.1	Safety Code for Floor and Wall Openings, Railing, and Toe Boards
2.)	B-20.1	Safety Code for Conveyors, Cableways, and Related Equipment
3.)	B-29.10M	Transmission Roller Chains and Sprocket Teeth
4.)	C-33.1	Safety Standard for Flexible Cord and Fixture Wire
5.)	Z535	Safety Color Code

d. National Bureau of Standards (NBS)

1.)	Handbook H28	Screw-Thread Standards

Copyright © 2018 by BNP Associates, Inc. (BNP)

e. National Fire Protection Association (NFPA)

1.)	NFPA No. 70	National Electrical Code Volume 2, National Fire Code
2.)	NFPA No. 79	Electrical Standards for Industrial Machinery
3.)	NFPA No. 80	Standard for Fire Doors and Fire Windows

f. NEC National Electrical Code (most current version)

g. Underwriters Laboratories (UL) Standards (Components shall be labeled appropriately)

1.)	UL 508	Industrial Controls Equipment
2.)	UL 508A	Industrial Control Panels
3.)	UL 508C	Power Conversion Equipment
4.)	UL 1998	Software in Programming Components
5.)	IEC 61508	Functional Safety Standard for Electrical / Electronic / Programmable Electronic (E/E/PES) Safety Related Systems

h. National Electrical Manufacturers Association Standards (NEMA)

1.)	ICS	Industrial Controls and Systems
2.)	MG1	Motors and Gear Motors

i. American Society for Testing Materials (ASTM)

1.)	A-36	Structural Steel
2.)	A-794	Sheets cold rolled
3.)	A-659	Sheets & Strip - hot rolled
4.)	A-307	Fasteners (Bolts)
5.)	A-563	Fasteners (Nuts)
6.)	F-844	Fasteners (Washers)

2. All equipment and accessory items furnished and installed under this Contract shall be governed at all times by applicable provisions of federal laws, including but not limited to the revision of the following in effect as of the Contract date:

a. Williams-Steiger Occupational Safety and Health Act (OSHA), of 1970, Public Law 91.596, most current version.

b. Occupational Safety and Health Administration (OSHA)

1.) 29 CFR Part 1910 Subpart D (Walking-Working Surfaces)
2.) 29 CFR Part 1910 -211 (Definitions)
3.) 29 CFR Part 1910 – 212 (General Industry Standards and Requirements) for machines
4.) 29 CFR Part 1917.48 (Conveyors)
5.) 29 CFR Part 1926.555 (Conveyors, Construction Industry Standards)
6.) 29 CFR Part 1926.1053 (Ladders)

c. Office of State Health Planning and Development (OSHPD)

d. American Society of Mechanical Engineers (ASME)

1.)	ASME B20.1 – 2006	Safety Standards for Conveyors and Related Equipment, and all Addenda up to and including ASME B20.1-2006

e. Conveyor Equipment Manufacturers Association (CEMA)

1.)	ANSI/CEMA 402-2003	Belt Conveyors
2.)	ANSI/CEMA B105.1-2003	Specifications for Welded Steel Conveyor Pulleys with Compression-type Hubs

f. International Building Code (IBC) for all stairs and handrails

1.11 WARRANTIES

A. General Warranty

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. Warrant all new BHS equipment for one (1) year against defective parts and labor.
2. Warrant all new BHS equipment for three (3) years against design defects.
3. Warrant all new BHS software, MCP Touchscreen Terminals, PC-type Computer Terminal Workstation and PLC system controls for three (3) years against design defects.
4. Assign the Owner all warranties for all materials and equipment received from Subcontractors and Suppliers.
5. The warranty for the BHS shall be as follows:

    a. Upon the Final Acceptance Date of the respective phase as related to this project. Submit a certified warranty statement summarizing the type of warranty coverage with the warranty commencement date and an outline of the BHS equipment that will be covered under the warranty.

B. Warranty Exclusion

1. This warranty shall not apply to any defects or inconsistencies, which are attributable to repair, alteration, misuse or abuses by any person other than authorized personnel or Subcontractors. Liability shall be limited to repairing or replacing defective or non-performing part(s) at no cost to the project.

C. Warranty Limitation

1. Liability shall be determined in the Contract Agreement and shall also include repairing or replacing defective or non-performing part or parts at no cost to the project.

D. Technical Support

1. Provide on-site technical support as defined by the Contract Documents and agreed upon by the Owner or their Representative. This support shall be by personnel qualified to advise the Owner on training, provisioning, start-up and maintenance of the equipment.
2. The technical representative(s) for warranty support shall be within 6 hours travel distance of Wilmington International Airport, the New Hanover County, State of North Carolina, where the equipment is to be located, as required by the Owner.

E. Royalties and License Fees

1. Pay all royalties and license fees and defend all suits or claims for infringements of any prior or patent rights and save the Owner harmless from liability, expense of loss on account thereof, with respect to any processes, devices, methods, articles, inventions, things or procedures used in the project.

F. Labor Warranty

1. Warranty support shall be provided as follows:

    a. Provide labor to accomplish any warranty repair work. In the event such labor is not provided in a timely fashion, pay the Owner to accomplish warranty labor repair with its maintenance staff.
    b. The BHS Contractor shall provide labor for work related to design deficiencies.

G. Parts Warranty

1. Terms

    a. Provide a parts warranty which states material and equipment furnished and installed shall be new and free from faults and defects in material, workmanship, detail or incorrect component selection; shall conform to the functional and technical requirements of this Section and Contract Drawings contained herein; shall comply with all laws, statutes, ordinances and codes applicable at the installation site; and shall be suitable for the intended purposes. Excessive wear shall be considered a defect within the provisions hereof.
    b. Parts shall be shipped freight pre-paid to the location specified by the Owner.

Copyright © 2018 by BNP Associates, Inc. (BNP)

Failed/malfunctioned parts shall be returned to the BHS Contractor, FOB, within ten (10) days of notification of detection of such failed/malfunctioned parts.

2. Spare Parts

a. Spare parts shall be made available for purchase by the Owner prior to the commissioning of the subsystem. The Owner may, taking the recommendations of the BHS Contractor, purchase such spare parts as it deems necessary, and said parts, shall be stocked on the Airport property. Stock control shall be by the Owner who shall grant reasonable access to the BHS Contractor's warranty service agency during the warranty period. All items withdrawn from stock shall be replaced, regardless of whether the item was purchased by the Owner or the Owner's Maintenance Group directly from the BHS Contractor or from a third party, pursuant to warranty services, within two weeks of such withdrawal.

b. Ending of the warranty period shall be contingent on the replacement of all stock withdrawn pursuant to warranty services whether the warranty service agency or the Owner accomplished such services. Where the BHS Contractor has cause to believe that an item or items may require stocking pursuant to the terms and conditions of warranty provisions, which item or items the Owner declines to stock, the BHS Contractor shall stock such items separately at no cost to the project. In no case shall the absence of appropriate spare parts in the Owner's spare parts stock be construed in any way to abridge or interfere with the responsibilities of the warranty services as defined herein.

H. Design Warranty

1. Terms

a. Provide a Design Warranty which states that the system, materials, equipment, software and high level and low level controls furnished and installed shall be free from faults and defects in design; shall conform to the functional and technical requirements of this Section and Contract Drawings contained herein; shall comply with all laws, statutes, ordinances and codes applicable at the installation site; and shall be suitable for the intended purposes. Excessive wear shall be considered a defect within the provisions hereof.

2. Design Failure

a. In the event a design failure occurs during the warranty period, replace all such components, assemblies or devices utilizing the design in a similar application in which the failure occurs by components, assemblies or devices redesigned to prevent such occurrences at no cost to the project. Submit proposed redesign drawings and re-selected component designations to the Owner for their approval. Issue a new warranty period upon the replacement of such redesigned items.

b. Components, assemblies or devices shall be considered as design failures if any of the following occurs during the warranty period:

1.) A leakage loss of over 10% of an operating fluid in any hydraulic assembly.
2.) A demand for frequent, unscheduled adjustment or other maintenance action in similar devices.
3.) Failure of a component to perform its specified function or a failure of a component to operate at its specified rate.
4.) Frequent activation of overload protection elements in similar devices.
5.) Loosening of anchoring or attachment provisions on similar devices.
6.) An increasing level of noise being generated by similar devices.
7.) A structural failure due to BHS supports, hangers, or headers.
8.) Inappropriate action of control or sensor elements during operational conditions.
9.) Occurrence of an accident or an imminent safety hazard revealed during operational conditions.
10.) Uncovering of a condition of specification non-compliance or degradation of specified functional requirements during the warranty period.
11.) More than 2 failures on one or more components or assemblies of components of similar construction or design, used in similar devices.

Copyright © 2018 by BNP Associates, Inc. (BNP)

12.) More than 2 unscheduled replacements of an expendable component in similar devices.

c. The Owner shall act to resolve any disputes regarding the definition of a design failure in a fair and equitable manner.

3. Period and Responsibility

a. If, within three (3) years from the date of Final Acceptance of the work, the work or the system, or any equipment, material or software is found, in any respect, not to conform to the Warranty set forth herein, within forty-eight (48) hours of notification by the Owner, initiate the following series of steps in order to correct the deficiency:

1.) Determine the cause of failure.
2.) Prepare drawings showing recommended design changes and submit to the Owner or their Representative.
3.) The Owner or their Representative shall comment with a change request or approval.
4.) Make design changes as requested.
5.) After the Owner or their Representative has approved the design, all components of the system incorporating the same design deficiency shall be modified as agreed upon by the Owner or their Representative.
6.) The Parts Warranty period and the Design Warranty period shall start again for the changed item/system on the date that the design change has been incorporated if the make, manufacture or model is replaced.

- END OF PART 1 -

Copyright © 2018 by BNP Associates, Inc. (BNP)

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. BHS Contractors and Integrators for the BHS of the Terminal Renovations and Expansion Outbound Baggage Handling System Program

1. Subject to compliance with requirements, the following firms or approved equal are qualified to bid prime turnkey implementation and perform as BHS Contractors and Integrators for this Project:

a. Automatic Systems, Inc., Kansas City, MO
b. Beumer Glidepath LLC, Arlington, TX
c. Daifuku (Jervis B. Webb, Inc.), Farmington Hills, MI
d. Daifuku (Logan Teleflex, Inc.), Louisville, KY
e. Diversified Conveyors, Inc., Memphis, TN
f. Equipment Erectors, Inc., Somerset, NJ
g. Five Star Airport Alliance, Inc., Salt Lake City, UT
h. Pteris Global (USA), Inc., Charlotte, NC
i. Siemens Airport Logistics, DFW Airport, TX
j. Vanderlande Industries, Inc., Marietta, GA

B. BHS Equipment Suppliers

1. Subject to compliance with requirements, the following firms or approved equal are qualified to perform as BHS equipment component suppliers for this project:

a. Beumer Glidepath LLC, Arlington, TX
b. Daifuku (Jervis B. Webb, Inc.), Farmington Hills, MI
c. Daifuku (Logan Teleflex, Inc.), Louisville, KY
d. Five Star Airport Alliance, Inc., Salt Lake City, UT
e. Fives Intralogistics Corp., Louisville, KY
f. Pteris Global (USA), Inc., Charlotte, NC
g. Siemens Airport Logistics, DFW Airport, TX
h. Vanderlande Industries, Inc., Marietta, GA

C. BHS Controls Subcontractors

1. Subject to compliance with requirements, the following firms, or approved equal, are qualified to perform as BHS controls subcontractors for this project:

a. Alliant Technologies, Louisville, KY
b. Beumer Glidepath LLC, Arlington, TX
c. Brock Solutions, Irving, TX
d. Control Touch Systems, Louisville, KY
e. Daifuku (Jervis B. Webb, Inc.), Farmington Hills, MI
f. Daifuku (BCS Group), Auckland, New Zealand
g. Diversified Automation Incorporated, Louisville, KY
h. Five Star Airport Alliance, Inc., Salt Lake City, UT
i. Pteris Global (USA), Inc., Charlotte, NC
j. Siemens Airport Logistics, DFW Airport, TX
k. Vanderlande Industries, Inc., Marietta, GA

D. BHS Equipment

1. In order to establish a minimum standard of quality and reliability, the following manufacturers, subject to compliance with requirements of Division 01, Section 012500 (Substitutions Procedures) have been listed for various component/components of the BHS.
2. This list has been presented to establish this standard and the manufactures on this list shall not be

Copyright © 2018 by BNP Associates, Inc. (BNP)

perceived or construed as favored or preferred. This list shall, in no way, preclude other manufacturers, provided that their equipment and components have been reviewed by the Owner or their Representative and determined to be of equivalent or similar quality, functionality, and reliability. The Owner or their Representative's decision in this regard shall be final. The use of specific product manufacturers or models on previous projects that are not identified on the following list of approved equipment does not constitute pre-approval on this project.

a. For Belting:

1.) Ammeraal Beltech
2.) B.F. Goodrich
3.) Fenner/Dunlop
4.) Forbo Siegling
5.) Goodyear Tire and Rubber Co
6.) Sparks Belting Company

b. For Belt Lacing:

1.) Clipper Belt Lacer Company

c. For Bearings:

1.) Baldor Dodge – An ABB Company
2.) Browning – a Regal Company
3.) Fafnir A Timken Company
4.) Sealmaster/Morse Industrial Corp. (SF, SFT, ST, STH Goldline or Sealmaster Material Handling (MH) Series) – A Regal Company
5.) SKF Bearing Services Company

d. For Clutches:

1.) Baldor-Dodge – An ABB Company
2.) Reliance Electric – An ABB Company
3.) Stearns Electric – A Rexnord Corporation
4.) Warner Electric

e. For Brakes:

1.) Baldor Dodge ("D" Type) – An ABB Company
2.) Stearns A Rexnord Corporation Company
3.) Warner Electric

f. For Motorized Pulleys:

1.) Rulmeca (Joki Design)
2.) Van der Graaf (model UMV)

g. For Power and Spiral Turns:

1.) PSC Flo-Turn, Inc.
2.) Interroll (Portec Design)
3.) Transnorm Systems

h. For Incline Plate Make-up Devices:

1.) Five Star Airport Alliance, Inc., (Utilizing the G&T Conveyor Company Design) Salt Lake City, UT
2.) Glidepath LLC
3.) Jervis B. Webb, Inc.
4.) Siemens Airport Logistics
5.) Vanderlande Industries, Inc.
6.) Pteris Global (USA), Inc., Irving, TX

i. For 45° Merges:

1.) Beumer Glidepath, LLC

Copyright © 2018 by BNP Associates, Inc. (BNP)

2.) Daifuku (Webb Design)
3.) Five Star Airport Alliance, Inc.,
4.) Interroll (Portec Design)
5.) Pteris Global (USA), Inc.
6.) Siemens Airport Logistics
7.) Transnorm Systems

j. For Control/Communication Products:

1.) Motor Starters:

a.) Allen-Bradley
b.) Cutler Hammer
c.) Square D (Type S)
d.) Telemecanique (TeSYS U-Line Series)

2.) Programmable Logic Controllers (PLCs):

a.) Allen-Bradley
b.) Siemens
c.) Telemecanique-Modicon and Quantum series

3.) Photoelectric Controls:

a.) Allen Bradley
b.) Banner Engineering Corp
c.) Cutler Hammer

4.) Variable Frequency Drives (VFD) – If utilized in the project:

a.) Allen Bradley/Rockwell Automation
b.) Lenze
c.) NORD Gear (Motor Mounted Only)
d.) Regal
e.) Siemens
f.) SEW Eurodrive
g.) Telemecanique (Altivar Series)

k. For Motor Control Panels (MCP Cabinets):

1.) EMF Company, Inc.
2.) Hoffman Engineering Co.
3.) Rittal Corporation
4.) Saginaw Control and Engineering

l. For Motors:

1.) Baldor Dodge – An ABB Company
2.) Baldor Reliance – An ABB Company
3.) Lenzel
4.) Nord Gear
5.) Regal
6.) SEW Eurodrive
7.) Siemens
8.) U.S. Motors – A Regal Company

m. For Reducers (shaft mounted):

1.) Baldor-Dodge ("TXT" ABHS Series) – An ABB company
2.) Browning – A Regal Company
3.) Lenze
4.) Nord Gear
5.) Regal
6.) SEW Eurodrive

Copyright © 2018 by BNP Associates, Inc. (BNP)

7.) Siemens
8.) Sumitomo

n. For Reducers (foot-mounted or base-plate mounted):

1.) Baldor-Dodge – An ABB company
2.) Browning – A Regal company
3.) Lenze
4.) Nord Gear
5.) SEW Eurodrive
6.) Sumitomo

o. For Gearmotors:

1.) Baldor-Reliance – An ABB company
2.) Lenze
3.) NORD Gear
4.) Regal
5.) SEW Eurodrive
6.) Siemens

p. For Roller Chains:

1.) Acme
2.) Diamond Chain Company
3.) Dodge
4.) Morse Industrial (A Bearing Distributors, Inc. Company)

q. For Rollers and Pulleys:

1.) Bryant
2.) Precision, Inc.
3.) Tecno Rulli srl, Verona, Italy
4.) The Chantland Company

r. For Signaling Devices (audible alarms):

1.) Allen Bradley
2.) Edwards Co. Signaling Products Div.
3.) Federal Signal Corporation
4.) Mallory Company
5.) Siemens
6.) Telemecanique

s. For Signaling Devices (visual alarms):

1.) Allen Bradley
2.) Cooper Crouse-Hinds
3.) Federal Signal Corporation
4.) Siemens
5.) Telemecanique

t. For Uninterrupted Power Supply (UPS):

1.) APC
2.) Eaton Powerware
3.) Leibert – A Regal Company

u. For Draft Curtains:

1.) TRAX Industrial Products

v. For Powered Fire/Security Doors:

1.) Raynor
2.) The Cookson Company

Copyright © 2018 by BNP Associates, Inc. (BNP)

3.) Vigneaux Corporation
4.) Airport Equipment Specialists, Inc.

w. For Soft Start Devices:

1.) Allen-Bradley
2.) Nordic
3.) Reuland Electric

x. For Power Regulators:

1.) Sola/Hevi-Duty Electric

y. Network Switches/Firewalls/Routers:

1.) Cisco Systems, Inc.

z. Computer Equipment:

1.) Dell Computer Corporation
2.) Hewlett-Packard
3.) NEC

2.2 MATERIALS

A. General

1. All welding and qualification of welders shall comply with AWS D1.1.
2. All fasteners shall be zinc-plated, cadmium plated or stainless steel. All fasteners shall be locked with lock nuts or lock washers.
3. Use of alternate materials

a. Whenever an article or any class of articles, devices or material are specified by the trade name or by the name of any particular patentee, manufacturer, or dealer, or by reference to the catalog of any such patentee, manufacturer or dealer, it shall be taken to mean and specify the articles, devices or materials specified and none other.
b. If the BHS Contractor desires to use any articles or materials which he believes are equal in quality, finish and durability, and equally as suitable for the purpose for which intended as the particular articles, devices or materials specified, he shall indicate his desire to the Owner or their Representative in writing.
c. The articles, devices and materials specified shall not be changed except with the written consent of the Owner or their Representative, and the BHS Contractor shall not contract, purchase or cause to be delivered any substitute articles, devices or materials prior to obtaining such consent.

B. Material

1. Structural Steel: ASTM A-36
2. Stainless Steel (Trim): AISC Type 304 with #4 Brush Finish
3. Rubber/Neoprene: ASTM D-2000

2.3 FABRICATION

A. General

1. Fabricate equipment-using steel clean and free from rust, rust pits, kinks and sharp bends. Use forming methods that will not fracture or otherwise damage the metal. Remove burrs, sharp edges, and sharp corners. Smooth all joints and round all corners. Align joints in components to ensure smooth conveyance of baggage.
2. Holes in metal side guards for photocell beams are to be "punched", not burned, and tapered from the inside (wide) to the outside (narrow).

Copyright © 2018 by BNP Associates, Inc. (BNP)

3. When two sections of conveyor bed meet, these joints shall be chamfered to ensure that there is no step-up condition between bed sections.

2.4 BELT CONVEYORS

A. Belting

1. General

a. All conveyor belting shall be flame retardant according to ISO 340, DIN 22103, ASTM D-378 and NFT-47108 or equal.
b. Belt widths shall be 3" less than the between frame (guard) dimension unless otherwise specified. Belt edges shall be sealed after being cut to width.
c. The actual length of belting installed on each unit shall be included on the system's drawings and in the spare parts list.
d. All belting shall have a minimum acceptable working tension of 100 pounds per inch of belt.
e. Submit cut sheets for all types of belting being proposed for this project for review and approval by the Owner or their Representative.

2. Conveyors

a. For level, general purpose baggage handling applications such as load, unload transport and inclines/declines of 7° or less use two ply urethane impregnate, solid woven fabric polyester or bare by bare (if not exposed to the public), top face of 0.02" PVC, smooth (public areas), maximum coefficient of friction of 0.3 with elongation of 1% maximum rated tension. For load conveyors provide belting that is flat lying, roll resistant and cut/wear resistant.
b. For incline and decline conveyors of greater than 7° use 0.08" PVC two ply urethane impregnate, solid woven fabric polyester or bare by bare, rough top, maximum coefficient of friction of 0.25 with elongation of 1% maximum rated tension.
c. For incline and decline conveyors or other locations where bag slippage may occur, the use of longitudinal rough top belt may be used. Habasit Trackmate, model 135 LR (or approved equivalent), shall be used.

3. Power Turns: Provide belts for power turns suitable for the application, as provided by the power turn manufacturer.
4. Spiral Turns: Provide belts for spiral turns suitable for the application, as provided by the spiral turn manufacturer.
5. 45° Merges: Provide belts for merges suitable for the application as provided by the merge manufacturer.

B. Belt Splicing

1. Lacing

a. All belt lacing (except for power turns) shall be of the Clipper "Unibar" type with a minimum #2 hook-type of the size recommended by the belt manufacturer for the belt being used. When cutting belts for proper length, sufficient material shall be allowed for take-up pulleys to be at a maximum of one-half the take-up distance with the belt running.
b. Belt lacing for power turns shall be of the Clipper type with either #1 or #1A hook-type of the size recommended by the belt manufacturer for the belt being used or as recommended by the power turn manufacturer. When sizing belts for proper length, sufficient material shall be allowed for take-up pulleys to be at a maximum of one-half the take-up distance with the belt running.
c. Belting and related hardware must be trimmed in a 1" deep "V" notch fashion, lacing connecting pin must be either enlarged by heating lacing connecting pin nylon jacket or bent 90° to prevent lateral movement of the pin.
d. Belt lacing for applications in 45° merge conveyors shall be of the Clipper brand type of fastener.
e. Belt lacing connecting pins for the Clipper type-lacing materials shall be of the nylon covered steel cable type of appropriate diameter for the lacing hooks being used.

Copyright © 2018 by BNP Associates, Inc. (BNP)

f. All rough top belting to be ground smooth within 1" of the cut end to allow proper seating of the belt lacing

2. Vulcanization

a. The option to vulcanize all belting material instead of utilizing belt lacing must be approved by the Owner or their Representative.
b. All belts shall be supplied as endless, hot-overlap finger splice joints, as per the manufacturer's requirements. Provisions shall be made within the conveyor frame and side guards to allow for future repair due to belt failure. For this purpose, removable side guards shall be provided at an appropriate location to allow for on-site positioning of a hot splice machine.
c. For power turns, new belting shall be spliced prior to installation and installed as per the manufacturer's recommendations.
d. Provisions must be made to ensure future accessibility of the appropriate power requirements unique to the vulcanizer.
e. If the Owner approves the use of vulcanization, supply a hot splice machine for the Owner's Maintenance personnel's use at substantial completion of the project. Additionally, provide the necessary training in the use of the vulcanization machine.

C. Pulleys

1. General

a. All shafts shall be designed to CEMA standard No. 402-1992 and all subsequent revisions. Shafts are to be AISI 1018 steel, polished and ground and within tolerances for the associated bearings.
b. All shafts shall be fabricated in one piece construction, with the shaft extending full length through the entire length of the pulley drum. Two piece shafts are unacceptable.
c. All pulleys are to be dynamically balanced. Rollers of eccentric material, such as standard pipe, are to be dynamically balanced.
d. Run-out:

1.) The maximum shaft run-out of all assembled pulleys, shafts and bearings under a no-load condition, measured from the centerline of the bearing to the end of the related shaft furthermost from the conveyor, shall not exceed .0075" per inch.
2.) The maximum run-out of any pulley shell shall not exceed .060".

e. Machining:

1.) Swaged:

a.) Pulleys shall be 10-gauge (minimum) thickness with 3/8" (minimum) thick end plates.
b.) End pulleys are to be swaged between centers to create a trapezoidal face with a taper from the pulley end to a minimum 25% of the pulley length thereby having 50% of the pulley flat in the center.

2.) Machined:

a.) If end pulleys are machined (not swaged) using Schedule 40 pipe, center plates must be made from 1/2" thick steel plate and shall have bored centers to facilitate a slip fit on the shaft.
b.) Pulleys are to be turned between centers to create the crown or trapezoidal. Pulleys shall be crowned from each outer end to within 1/2" of the centerline leaving 1" straight but turned true to standard thickness required for each pulley application. When welding is involved, turn the assembly after welding to true the weldment and create the crown/trapezoidal.
c.) The recommended minimum wall thickness after crowning or trapezoidal shall be as follows:

Copyright © 2018 by BNP Associates, Inc. (BNP)

Pulley Diameter	Minimum Wall Thickness
8-5/8"	5/32"
12-3/4"	7/32"
16"	11/32"
18"	11/32"

f. Hub plates shall be made from 3/8" (minimum) thick steel plate turned and bored to fit on the shaft or have a taper locking hub arrangement welded in the end plate.
g. All pulleys shall be manufactured for high-speed application.
h. All bearings shall be supplied pre-lubricated and sealed for life with plugs inserted into the grease fitting bore. Bearings are to be secured to their respective shafts with an approved form (as specified in the submittal procedure) of eccentric or squeeze locking type collar arrangement. Bearings shall be provided with metal caps which are screw fastened with tamper proof fasteners.

2. Powered Pulleys

a. Drive pulleys

1.) All drive pulleys for intermediate-type drives shall be lagged with vulcanized lagging of 70 Durometer rating with a minimum thickness of 3/8". Lagging material on individual pulleys shall be compatible with the type of belting used on the associated conveyor. Examples of lagging material are as follows:

a.) Minimum 70 durometer carboxiled nitrile
b.) Minimum 70 durometer thermo-set urethane

2.) Powered pulleys shall be steel, crown faced, flat faced, or trapezoidal (per the belting manufacturer's recommendation), shall be equipped with taper-lock type hubs with 1-7/16" minimum diameter shafts mounted in eccentric locking-type or squeeze locking type precision and ground flange-type ball-bearing units.
3.) The minimum acceptable belt wrap on drive pulleys shall be 210°.
4.) Drive pulleys for end-type drives must be lagged with a minimum 3/8" thick vulcanized lagging of 70 durometer, again using lagging material compatible with the type of belting used on the associated conveyor. In addition, powered pulleys shall be 6" with taper lock hubs with 1-7/16" minimum diameter 1018 TGP (turned, ground and polished) steel shafts mounted in eccentric locking type precision and ground flange ball bearing units.
5.) Drive pulley and shaft sizes shall be determined by maximum belt pull. The following are provided as examples:

a.) Light-Duty: 250 lb. maximum belt pull. Consists of a 6-3/4" minimum diameter drive pulley with a 1-7/16" minimum diameter shaft. Bearings mounted with two bolts can be used with light duty applications.
b.) Normal-Duty: 500 lb. maximum belt pull. Consists of an 8-3/4" minimum diameter drive pulley with a 1-11/16" minimum diameter shaft. Roller chain, if used, shall not be less than RC - 60. Bearings mounted with two bolts can be used with normal duty applications.
c.) Intermediate-Duty: 1000 lb. maximum belt pull. Consists of a 10-3/4" minimum diameter drive pulley with a 1-15/16" minimum diameter shaft. Roller chain, if used, shall not be less than RC - 60. Bearings mounted with four bolts are to be used with intermediate duty applications.
d.) Heavy-duty: 1,500 lb. maximum belt pull. Consists of a 12-3/4" minimum diameter drive pulley with a 2-7/16" minimum diameter shaft. Roller chain, if used, shall not be less than RC - 80. Bearings mounted with four bolts are to be used with heavy-duty applications.

b. Motorized Pulleys

1.) The reduction gears and motors associated with power driven pulleys shall be

Copyright © 2018 by BNP Associates, Inc. (BNP)

mounted in an oil bath for lubrication and heat dissipation. The design of the pulley shall permit the lubrication oil level to be checked without dismounting or removing the drum motor from the conveyor frame. The lubricant shall be rated for 10,000 hours of life. Gears shall be hardened and ground steel alloy.

2.) In addition, drums shall be machine crowned and lagged to facilitate belt tracking. Lagging material on individual motorized pulleys shall be compatible with the type of belting used on the associated conveyor.

3.) Power: The power supply shall be connected directly to the starter without the use of slip rings and brushes. The terminal board housing (if used) must be capable of being rotated 180° to facilitate the direction of cable inlet.

3. Non-Powered Pulleys

a. Snub Pulleys

1.) Snub pulleys are to be installed on all conveyors at all points where the slack portion (non-load carrying portion) of the conveyor belt makes a change in vertical or horizontal direction. At a minimum, such points of vertical or horizontal change shall include:

a.) Points immediately adjacent to head, tail, take up and drive pulleys.

b.) Points on the underside of any conveyor where the belt bends vertically or horizontally (nose-over sections).

2.) All snub rolls shall be a minimum of 4" in diameter and equipped with fixed (welded) 1-7/16" minimum diameter shafts mounted in eccentric locking-type or squeeze lock type precision and ground flange-type ball-bearing units.

3.) Bearings are to be secured to their respective shafts with an approved form (as specified in the submittal procedure) of eccentric or squeeze locking type collar arrangement.

4.) All snub rollers used for belt tracking shall be equipped with jacking bolts to facilitate adjustment. Jacking bolts must be equipped with jam nuts to prevent the jacking bolts from loosening.

b. Take-Up Pulleys

1.) All take-up pulleys shall be steel, crown faced, flat faced, or trapezoidal (per the belting manufacturer's recommendation), and at a minimum 4" in diameter. Take-up pulleys are to be equipped with taper-lock type hubs or squeeze lock type and 1-7/16" minimum diameter shafts mounted in eccentric locking-type precision and ground flange-type ball-bearing units. Pulleys must be mounted on threaded take-up devices with steel guides and have a minimum allowable adjustment of 10" (6" on conveyors less than 12' in length). Take-up mechanism for queue conveyors and short takeaway merges shall follow the BHS manufacturer’s specifications for their standard design.

2.) All conveyors shall be provided with take-ups for field adjustment of 2% of the conveyor bed length. Take-ups shall be an integral part of the drive frames on all intermediate-drive conveyors.

3.) Automatic take-up devices shall be installed:

a.) On all conveyor sections in excess of 60' in length

b.) On conveyors which operate outside the building or are subject to extreme temperature and humidity changes.

c.) In areas where belts are subject to stretch/shrinkage that will cause weekly adjustment.

4.) Spring take-ups are not acceptable. Design of the pulleys shall be subject to by the Owner or their Representative’s approval.

5.) Take-ups used in heavy-duty or high-speed applications shall be a minimum of 6" in diameter with a minimum 1-7/16" diameter shaft and shall otherwise comply with the above specifications.

6.) Bearings are to be secured to their respective shafts with an approved form (as

Copyright © 2018 by BNP Associates, Inc. (BNP)

specified in the submittal procedure) of eccentric or squeeze locking type collar arrangement.

7.) All take-up pulley bearing adjustors are to be chain coupled so that both bearings are tightened and slacked in equal increments. All belt lengths shall be adjusted so that the respective take-up pulley adjustments shall permit a further adjustment of 85% before the belt length needs to be shortened. The 15% maximum adjustment of the take-up pulley adjusters shall have been accomplished prior to Acceptance Inspection and Testing.

c. Head and Tail Pulleys

1.) All non-powered head and tail pulleys shall be steel, crown-faced or trapezoidal and equipped with taper-lock type hubs. Pulleys shall be equipped with shafts having a minimum diameter of 1-7/16" mounted with eccentric locking-type precision and ground flange type ball bearing units. All head and tail pulleys shall be a minimum of 6" in diameter x #10 gauge wall. In addition, all head and tail pulleys shall be of a single-piece construction having steel end discs attached to the rim by continuous welding.

2.) Slider beds shall be arranged to minimize the gap between the end section and the end pulley such that the gap does not exceed 1" with a 1/2" design objective.

3.) All head and tail pulleys used for belt tracking shall be equipped with jacking bolts to facilitate adjustment. Jacking bolts are to be equipped with jam nuts to prevent the jacking bolts from loosening.

4.) Bearings are to be secured to their respective shafts with an approved form (as specified in the submittal procedure) of eccentric or squeeze locking type collar arrangement.

5.) Finger Safety Guards:

a.) All end pulley rollers in staffed areas (load conveyors (public and non-public areas) or run out conveyors) shall be narrower than the belt width by a distance not less than two times the difference between the belt width and the between-guides width of the conveyor (usually 6 inches).

b.) A securely fastened steel finger guard matching the radius of the end roller shall take up the remaining width on each side of the roller. The BHS Contractor shall ensure that the outer surfaces of the finger guards are smooth and that the junctions between the finger guards and the slider bed and that between the finger guards and the pulley do not subject the belting to any undue damage or wear. Attachment of the finger guards shall be such that the guards will move with the pulley when it is adjusted, therefore ensuring proper alignment.

c.) At the tail end of load belts, pulleys shall also be covered with a removable metal shroud located just above, but not in contact with, the conveyor-belting surface. Where exposed to public view, these pulley shrouds shall be constructed of stainless steel matching that used on their respective conveyors (Type 304 stainless steel with #4 brushed satin finish, unless otherwise specified).

d.) Submit to the Owner or their Representative the proposed finger safety guard design for review and approval.

4. Return Rollers/Idlers

a. Return rollers shall be constructed from 12-gauge steel and must be full-faced with a minimum 2-1/2" diameter equipped with an 11/16" hex axle for belt speeds up to 150 fpm and a minimum of 3-1/2" in diameter with a 11/16" hex axle for belt speeds above 150 fpm.

b. All hex shaft return idler rollers shall be equipped with sealed, permanently lubricated, caged, semi-precision type ball-bearings. Return idlers shall be located on centers not exceeding 10', with spacing being reduced in areas where belting may drag against the floor or conveyor structure. The shafts shall be mounted to the conveyor bed with adjustable retainers for proper belt tracking.

Copyright © 2018 by BNP Associates, Inc. (BNP)

c. Return rollers must not be used at snub points.
d. Provide a minimum of one return roller per 10'-0" section. The position of the return rollers shall assure that the return belt is routed and supported so that it does not contact any stiffening members. Mounting for the end of each return roller shall be adjustable for belt tracking.
e. Provide return roller finger guards at all possible return roller mounting positions where accessible by personnel.

5. Tapered Rollers

a. To facilitate changes of direction up to 15°, 5° tapered rollers having a large end diameter not less than 6" with shaft size not less than 1" shall be installed. The number of required rollers is determined by dividing the angle of directional change by 5.
b. Tapered rollers are to be slave driven from the powered tail pulley of the adjacent downstream conveyor. The tail pulley used to drive the tapered roller must be lagged. Lagging material on individual pulleys shall be compatible with the type of belting used on the associated conveyor.
c. Tapered roller units are to be installed with conveyor underpans and guards as specified elsewhere.
d. To minimize the gap between a tapered roller and the adjoining conveyor, ensure the conveyor end roller is extended a minimum of 1/8" beyond the frame.

D. Drive Assemblies

1. Submit to the Owner or their Representative for approval a schedule of all drive assemblies showing configuration of motor and reducer assembly. Minimize the number of conveyor drive configurations and ensure that the design does not restrict maintenance access in and around the conveyor drive maintenance access area. In all cases, design and install the equipment to maximize the maintenance access around the conveyor drive section.
2. End-type drive units may be used for conveyors 25' or less in length, with intermediate drives used for conveyors over 25' long.
3. The configuration of the drive assembly motors and reducers shall be based on a direct shaft mounted speed reducer and gear box design to simplify the installation, and maintenance of the equipment, noise levels, and spare parts considerations. The selection of the drive assembly motors and speed reducers shall be based on efficiency, low noise, sized for the application, achieves long service life and has low maintenance.
4. The use of a non-direct shaft mounted speed reducer and gear box design shall only be permitted in select locations upon the review and approval of the Owner or their Representative.
5. For non-reversing conveyors, the drive assembly shall be located towards the head end of the conveyor.
6. To achieve maximum drive aisle clearance (minimum 8’-0” from finished floor to bottom of conveyor or overhead support structure) under the conveyor, the BHS Contractor is permitted to utilize a low profile drive configuration (in addition to a side clip support attachment configuration), only in locations over drive aisles and cart staging areas. Submit drawings showing these areas where low profile drive configurations and/or side clip support attachments will be utilized to the Owner or their Representative for approval.
7. Motors:

a. The conveyors shall be driven by AC induction motors (except where motorized pulleys are used). The motors shall conform to AIEE, NEC and NEMA standards. These motors shall be equipped with two-groove minimum, taper-lock type hubs, and “A” or 3VX -belt sheaves.
b. Motors shall be sized for maximum load and belt speed requirements under continuous operation (minimum of 1 HP unless approved by the Owner or their Representative) and, where applicable, shall be capable of withstanding shock caused by frequent starting and stopping under full load conditions. Motor FLA shall be measured with full load during load tests and any motor that draws more than the name plate FLA (after start up in rush current has flattened) must be replaced with a motor of appropriate size that will result in no more than the max name plate FLA during load test.
c. Motors shall also be of the constant speed (nominally 1800 RPM), continuous service, and

Copyright © 2018 by BNP Associates, Inc. (BNP)

ball-bearing type with a minimum of class "F" insulation. For 2 HP motors and smaller class "B" insulation shall apply.

d. With the exception of "High-Slip" design motors, for applications that require dual drives, and motors that are controlled by "VFDs" (if utilized in the project), all of the BHS motors shall be copper-wound NEMA Design "B" open drip proof or TEFC with Class F insulation, utilize a "T-frame" base, and shall be provided with overload protection in the motor control panel. These motors shall have a minimum of 1.15-service factor. High-Slip Motors are required by specification where the use of dual drives is used (such as the slope plate make-up device). These motors shall be copper-wound NEMA Design "D", Class "H" Insulation at 1.0 Service Factor with Class "F" temperature limits. Inverter Duty or Inverter Ready Motors shall be used at "VFD" controlled applications. These motors shall be copper-wound NEMA MG1, Part 31 Rated Design "B", Class "H" Insulation at 1.0 Standard Service Factor with Class "H" temperature limits. All motors shall be of the "high efficiency - low energy" type.

e. All motors shall meet the following criteria:

1.) Low noise
2.) Fitted with low noise fan reduction guard or equivalent.

f. Motor size selection shall be based on the design load and friction coefficient requirements as described in these specifications. Motor size shall not exceed 7½ HP, unless otherwise approved by the Owner or their Representative. Use minimum 1 horsepower motors (unless other specified or approved by the Owner or their Representative). All drive motors shall be provided in 1, 1½, 2, 3, 5 or 7½ horsepower. Size conveyor equipment drive motors to permit start-up under full load conditions at the specified frequency of start-up cycles per minute without exceeding a temperature rise of 68°C based on an ambient temperature of 40°C. Provide motors designed for 480 VAC, three phase, 60-Hertz operation.

g. C-faced motors or motorized pulleys (with VFD control) can be utilized wherever available space precludes a shaft-mounted reducer. Such usage shall be coordinated with the Owner or their Representative.

h. Motor mounts shall be equivalent in function to Dodge Type "A" slide motor bases with bolt holes drilled and tapped, or tack-welded nuts under the holes in the top portion of the mounting plate. Use of loose nuts to hold the motor mount is unacceptable. Provide jacking bolts to resist effect of belt or chain pull on foot mounted motors.

i. On all belts with frequent start/stop operations, such as indexing belts, all motors shall be continuous-running NEMA-B design, coupled with clutch/brake arrangement as necessary.

j. All clutch/brake discs shall not contain any asbestos material.

8. Reducers

a. Shaft-mounted reducers shall be attached with tapered type bushings or full length bore with keyway.

b. Reducers shall be sized for a Class II application (minimum). Based on actual motor horsepower, the service factor required to obtain an L10 life of 70,000 hours shall be as follows:

1.) For reducers utilizing ball bearings the service factor used shall be 2.4.
2.) For reducers utilizing roller bearings the service factor used shall be 2.2.

c. Reducers shall have adequate provisions for drain, fill, inspection ports and sight gauge. The manufacturer's recommended lubrication shall be attached to the reducer by means of a riveted or bolted stamped metal tag. All units shall be installed with proper lubrication and vent plugs intact upon start-up of conveyor.

d. Reducers used on inclines where roll-back would be critical shall be equipped with "backstop" devices or brake motors.

e. All bearings within the reducer shall have a minimum L-10 life of 70,000 hours based on service factor and loading of conveyors, and on the manufacturer's published data showing load rating of each bearing used.

9. General Drive Requirements

Copyright © 2018 by BNP Associates, Inc. (BNP)

a. Where applicable, all gear reducer-mounting frames shall be fabricated from 1/4" thick steel "C" channels. The mounting frame shall be so designed to allow bolting to both the bottom and sides of the conveyor bed. The mounting frame shall be a totally separate weldment that can be unbolted to allow for installation as either a right or left hand drive. The mounting frame shall span the full width of the conveyor bed and attach to both sides of the bed frame.
b. Electro-mechanical brakes, if required, shall be internally mounted. The stopping torque shall be at least equal to the starting torque of the motor.
c. The drive unit shall be provided with a factory warranty for 2 years or 15,000 operating hours, whichever is longer.

10. Mounting

a. All mounting installed shall ensure that the maintenance access around the conveyor drive section is maximized. The following requirements may not be applicable in certain applications.
b. C-Faced

1.) In-Line foot mounted reducer is an acceptable mounting method.
2.) The C-faced configuration with VFD control used on conveyors capable of continuous stop/start operation (i.e. queues or indexing conveyors) shall be capable of a minimum of 60 continuous start/stop operations per minute in an unloaded condition.

c. Foot Mounted or Base-Plate Reducer and Motor Mount

1.) The gear reducer shall be mounted on a fully adjustable mount. To allow for fast, easy motor and gear reducer replacement and adjustment, the mount shall be designed as follows:

a.) The mount shall be a two-piece assembly:
b.) The bottom portion can be bolted or welded to the mounting frame (as specified above).
c.) The top portion shall be designed to slide over the bottom portion and be adjustable via a single bolt adjustment. The top of the motor mount shall have bolt holes drilled and tapped to accept the layout pattern as the gear reducer mounting feet or the multi-mount feet.
d.) Use of tack-welded nuts under the holes in the top portion of the mounting plate shall be acceptable in lieu of tapped holes; however, the use of nuts to hold the motor in place shall not be acceptable.
e.) The purpose of this design is to allow replacing the motor by using an extension and properly sized socket from above without having to hold locking nuts.
f.) Use of Dodge Type “A” Slide Motor Bases is recommended, or an approved equal, for this application.
g.) All drive units shall be equipped with a suitable guard of "clamshell" design with tamper-proof fasteners and fabricated from a minimum of 16-gauge steel. All guards shall comply with applicable OSHA standards and have an expanded or slotted metal-screened window to allow belt inspection without removal of the guard.

11. All drive motors and reducers shall be equipped with drip pans, fitted with drain plugs to assist with clean up. The drip pan shall be constructed out of minimum 14-gauge steel, unless otherwise approved by Owner or their Representative, with minimum ¾” high sides on all four edges. The drip pan shall be appropriately mounted such that the pan must be secured in the horizontal attitude and shall not impact maintenance access.
12. Whenever possible, all drive sprockets and V-belt sheaves shall have a taper-lock type of hub construction, with keyways. When keyways are used, they shall be secured by two sets of screws, one on top of the other to ensure positive locking of keyway. Sprockets shall be steel with a minimum of thirteen Type B form teeth.
13. Driving and driven sheaves shall be (minimum) two-groove "A" or 3VX section sheaves with

Copyright © 2018 by BNP Associates, Inc. (BNP)

taper-lock type hubs.

14. Roller chain shall be compatible with the torque and horsepower requirements of the application and shall be RC-60 minimum size. The roller chain ends shall be connected with a removable connecting link.
15. All pulley and sprocket adjustments provided for the purpose of adjusting belt tension, belt tracking, drive chain tension, and drive chain alignment shall incorporate a positive means of adjustment and restraint (i.e., tensioning screws and locking nuts). Slotted holes for mounting bolts shall not in themselves be considered satisfactory.
16. Chain drive sprockets shall be designed for a sprocket ratio between the driven and drive sprockets as close as possible to 2:1, but not less than 1.5:1 or greater than 2.25:1. The maximum size for driven and drive sprockets shall be 35 and 18 tooth respectively. Wherever possible within the standard range of stock Taper lock-type sprockets, hardened tooth sprockets shall be provided.

E. Flexible Couplings

1. Mount coupling hubs to their respective shafts with keys and two setscrews, one of which shall be over the key and the other 90° from the key. When keyways are used, they shall be secured by two sets of screws, one on top of the other to ensure positive locking of keyway. The use of a screw-locking compound in lieu of two (2) setscrews is acceptable.
2. Select the coupling so as to permit the replacement of internal parts without removal of the motor or reducer.

F. Intermediate Sections

1. Provide conveyor frames capable of supporting a uniform load as specified with supports at a maximum center distance of 10'-0".
2. Construct the slider bed shell of 12-gauge minimum hot rolled steel and designed to present a smooth surface to the belt. The slider bed shall be well braced for rigid construction with the side frames a minimum of 6" x 1-1/2" channel or equivalent. A minimum of 1 1/4" x 1-1/4" x 3/16" angle stiffeners shall be welded to the underside of the slider bed at a maximum center distance of 3'-4" on transport conveyors and 2'-6" centers on load and unload conveyors. Butt-coupled joints shall be provided.
3. When two (2) sections of slider bed meet, both sections shall have chamfered slider bed lips to ensure that there are no step-up conditions between slider beds.

G. Floor Supports

1. Provide floor supports for conveyors located within 7’-6” of the floor that is shown on Contract Drawings. Each conveyor segment shall be independently supported. Locate floor supports within 3” of conveyor end pulley assembly or within 12” from intermediate section joints.
2. Supports shall be on 5'-0" centers on loading/unloading conveyors and on 10'-0" maximum centers elsewhere. In all cases, each bed joint shall be supported.
3. All floor supports shall be of an “H” type design (i.e. two legs with a horizontal brace member) with vertical field adjustability of +/- 3". Floor support vertical members shall be constructed of 10 gauge, hot rolled formed steel channel with 10 gauge, hot rolled steel universal foot and head plates.
4. All conveyor floor supports shall be secured to the floor with a minimum of two (2) anchoring devices per leg (e.g., stud expansion anchor bolts).
5. All conveyors shall be adequately sway braced in order to ensure that there is no lateral or longitudinal displacement.
6. All support structure must be designed and installed so that maintenance access to the conveyor components and access to catwalks, work areas and drive aisles are not blocked.
7. The location of the floor support shall not impede the installation/removal of the conveyor gap pan.

H. Overhead Supports

1. The BHS Contractor is responsible for the design and structural integrity of all bolts, hangers, and support structures, and is to provide all necessary materials required for installation.
2. Provide overhead supports for conveyors located 7’-6” or more above the floor that is shown on the Contract Drawings. Locate overhead supports at intermediate section splices or within 1'-0" of

Copyright © 2018 by BNP Associates, Inc. (BNP)

intermediate section splices at 10'-0" maximum spacing.

3. All supports shall not exceed a 10'-0" maximum on-center spacing. In all cases, each bed joint shall be supported.
4. Ceiling hangers of threaded rod shall have a minimum diameter of 3/4" with structural angle, channel, unistrut or pipe sills. The hangers shall have provisions for anchoring to the building structure and header steel. A Structural Engineer must approve all hanger supports.
5. Threaded rods shall have a lock washer, a single flat washer, and a single nut above and below any header steel channel assembly. A 4" x 4" x ¼" minimum steel support plate shall be used on the load bearing side of the header between the channels and flat washer.
6. All conveyors shall be adequately sway braced in order to ensure that there is no lateral or longitudinal displacement, providing a rigid and rugged installation. Spacing must not exceed 20'-0".
7. Installation and layout of header steel and all support structure shall not pose interference to maintenance and operation access.
8. Repair/replace any fireproofing materials removed to allow the installation of BHS equipment header steel and support structures.
9. Equip all hangers with vibration isolators to ensure that there is no noticeable vibration transmitted to the building. Submit the proposed type of vibration isolator for review and approval by the Owner or their Representative.
10. Where catwalks are specified, the conveyor and adjacent catwalks shall be supported by a double sill configuration wherever possible without inhibiting maintenance and operational access. A single sill application is permissible at specific locations as approved by the Owner or their Representative.
11. To achieve maximum drive aisle clearance (i.e. minimum 8'-0" from finished floor to bottom of conveyor or overhead support structure) under the conveyor right-of-ways the BHS Contractor is permitted to utilize a side clip attachment configuration for the conveyor hanger to support the bed section instead of a sill type application. Submit drawings showing those areas where a side clip attachment configuration is to be utilized to the Owner or their Representative for approval.

I. Safety Guards

1. Provide and install conveyor underpans on conveyors with clear heights between 18" and 7'-6" above the floor or within an envelope around a catwalk defined as 7'-6" high and 4'-0" wide on either side of such catwalk. Fabricate underpans of either solid sheet metal or expanded metal at least 14 gauge thick and fasten to the conveyor intermediate section. The underpans, regardless of type shall be hinged without a removable pin on one side and provided with tamper proof fasteners on the opposite side for easy maintenance access, with appropriate tools; the pin shall have a lanyard attached to reduce potential of losing the pin. Sheet metal screws will not be accepted.
2. Protect all exposed moving parts of conveyors, such as, but not limited to, pulleys, rollers, lower or return belts, shafts and couplings less than 7'-6" above the floor or within an envelope around a catwalk defined as 7'-6" high and 4'-0" wide on either side of such catwalk. The guards shall be made of sheet metal not less than 14 gauge thick and provided with a piano-hinge and with tamper proof fasteners for easy maintenance access, with appropriate tools. Sheet metal screws will not be accepted.
3. Install appropriate safety guarding secured with tamper-proof fasteners on all exposed parts associated with the conveyor drive's rotating shaft and direct drive gearbox, in compliance with OSHA Standards 1910.219. Ensure that the proposed safety guarding does not restrict maintenance access and it is easily removable with appropriate tools, as the location requires, for maintenance access.
4. Protect all exposed parts of conveyors, such as, but not limited to, pulleys, rollers, lower or return belts, shafts and couplings within the Checked Baggage Screening work areas (i.e., load and unload conveyors) with a metal shroud on both sides of the conveyor segment(s) to protect the TSA's staff from the exposed moving parts, and to prevent items from falling under the load and unload conveyors. The guards shall be made of sheet metal not less than 14 gauge thick and hinged and pinned for easy maintenance access. Fasten with tamper-proof fasteners with captured nuts or similar means of avoiding losing parts.
5. Enclose all drive chains and belts using sheet metal protection covers at least 16 gauge thick. Hinge the covers at one end for ease of maintenance and size the covers with sufficient clearance to prevent

Copyright © 2018 by BNP Associates, Inc. (BNP)

contact to chains and belts. Fasten with tamper-proof fasteners with captured nuts or similar means of avoiding losing parts.

6. Eliminate or round unguarded exposed sharp corners and edges of items such as, but not limited to, support legs, braces and trim, to prevent injury to personnel or damage to their clothing. Locate no overhead steel framework, conveyor part, or support structure less than 7'-6" above any catwalk, ramp or stair tread nose. If due to building constraints, support structure is less than 7'-6", the structure, framework, and supports shall be encased in padding, identified with safety marking (yellow/black stripped tape) and a prominently positioned low overhead warning sign.
7. Install tamper proof fastened bearing covers on all exposed rotating shafts in workstation areas and in all maintenance areas with adjacent catwalks and/or walkways, if these areas are not otherwise protected by conveyor shrouding. Workstation areas shall, at a minimum, include load and unload conveyors. Install appropriate safety guarding on all exposed parts associated with the conveyor drive's rotating shaft and direct drive gearbox, in compliance with OSHA Standards 1910.219. Ensure that the proposed safety guarding does not restrict maintenance access and it is easily removable with appropriate tools, as the location requires, for maintenance access.
8. Install tamper proof fastened finger guards on all Return/Idler Rollers on conveyors not equipped with underpans.
9. Gap pans must be provided and installed on all conveyor-to-conveyor junction points or transfer locations, where there is any likelihood of small objects falling to the floor or catwalk. Gap pans must be solid sheet metal not less than 12 gauge, unless otherwise approved by the Owner or their Representative, with minimum 2-inch high sides on the edges. The gap pan must be no wider than the conveyor width and 8-12 inches long. Mounting must be such as to permit easy lowering and removal for cleaning.
10. Drive pans shall be provided and installed on all conveyor drive sections. Drive pans must be solid sheet metal. They shall be no wider than the conveyor and associated catwalk width, and no longer than the drive section.
11. All gearbox assemblies shall be equipped with drip pans. The drip pans shall be fitted with drain plugs to assist with clean up. Drip pans shall be solid sheet metal, not less than 12 gauge, unless otherwise approved by the Owner or their Representative, with minimum ¾" high sides on all four edges. The drip pan shall be a bolt-mounted unit of the gearbox assembly.
12. Breakaway End Cap Safety Guard

    a. Provide a safe and reliable breakaway end cap safety guard on all run out conveyors that will immediately stop the conveyor and prevent injury to personnel and damage to baggage in the event that a person or part thereof or a bag gets lodged between the conveyor belt and the end cap.
    b. The design of the end cap safety guard shall not cause undue nuisance alarms during ordinary operation. Activation of the end cap interlock shall annunciate an alarm on the MCP Touchscreen Terminal and the BHS PC Type Workstation.
    c. When resetting the "tripped" end cap interlock device, the operator must go through the normal subsystem startup procedure following all safety starting procedures.
    d. Paint the end cap safety yellow to comply with all safety requirements.

13. Refer to "Head and Tail Pulleys" section of this specification for details on end pulley finger safety guards.

J. Side Guards

1. Provide side guards the full length of both sides of all conveyors except at points that baggage is loaded or removed.
2. Provide hinged or removable sections only where overhead clearance restricts access for clearing jams. Design hinged or removable side guards to permit rapid removal (removable without tools). The design must preserve rigidity and alignment equivalent to fixed side guards. The Owner or their Representative must approve all locations where hinged or removable sections are to be used.
3. Side guards shall be minimum 12-gauge hot rolled steel, integral to the slider bed. Side guards shall incorporate a formed 90° edge turned away from the conveyor and a formed 90° edge turned down to eliminate sharp edges. There shall be no gap between the side guard and bed section that can cause jams or baggage tags to be snagged/ripped off.

Copyright © 2018 by BNP Associates, Inc. (BNP)

4. Use Type 304 stainless steel with #4 brushed satin finish uniform throughout (unless otherwise specified by the Owner or Architect) passenger areas (such as but not limited to check-in and claim), the oversize slide within the TSA's checked baggage screening area, and through penetrations into non-public areas. Installation of all stainless steel shall incorporate smooth flush edge seams. Radius type edges are not acceptable.
5. All stainless steel back guards shall incorporate stiffening supports that are attached to the conveyor frame by means of a welded or bolted connection. The stiffening supports shall be attached to the stainless back guarding by means of a key holed slot in the support and a welded stud on the back guarding.
6. Use cold rolled or hot rolled low carbon steel primed and painted on both surfaces in all interior areas.
7. Provide side guards with vertical stiffeners a maximum of 40" on center for transport conveyors and 30" on center for load and unload conveyors. Make the stiffeners from steel angle at least 1-1/4" by 1-1/4" by 3/16".
8. Provide 30° transition panels between side and back guards of different heights.
9. Conveyor Side Guard Heights:

    a. Unless otherwise specified on drawings, construct conveyor side guards for this project to the following heights:

Conveyor Type	Side Guard Height
Check-in or Outbound Transport Take-away Back Guards or Ticket Counter Runout Back Guards	21"
Transport Conveyors	12"
Incline/Decline conveyor Side Guards	12"
Decline-fed Power Turns (flat or spiral)	21"
Power Turns (flat) Fed by Straight Conveyors	12"
Power Turns (spiral) Fed by Straight Conveyors	12"
45° Merge Side Guards	12"

10. Provide holes 1.5" in diameter located either 2.5" or 3" (must be consistent, e.g. all 2.5" or all 3") from the top of the belt to the center of the hole through side guides for photocell beams as required. Punch the holes with a dimple away from baggage flow to minimize the possibility of snagging a bag and causing a jam. Deburr all photocell holes so that they are free of sharp edges and burrs.
11. Provide removable side guards at locations installed facility equipment / components require additional maintenance access.
12. Mounting of any mechanical or electrical equipment on the outside radius side guard of power turns is not acceptable since it restricts maintenance access to the outer perimeter chain or guide bearings of the turn belt.

K. Break-Overs

1. Provide break-overs wherever conveyors follow a convex curve.
2. Vertical or horizontal to vertical bends shall be constructed in the same manner as slider bed conveyor sections. The bed shall have a 10'-0" radius break-over slider bed to effect a smooth change in belt direction.
3. For return belt idling, vertical horizontal to vertical bends shall be equipped with a snubber pulley to ensure that the return belt does not extend below the conveyor frame.

L. Bearings

1. All bearings shall be pre-lubricated, self-aligning, anti-friction and sealed for the specified life of the bearing. Lubrication fittings shall be removed (removal to be approved by the Owner or their Representative) at the time of installation or at the factory and replaced with appropriate plugs.
2. All bearings shall have a minimum L-10 life of 70,000 hours based on service factor and loading of

Copyright © 2018 by BNP Associates, Inc. (BNP)

conveyors, and on the manufacturer's published data showing load rating of each bearing used.

3. All bearings shall be surface-mounted flange bearings attached to the outside of the conveyor bed.
4. Bearings are to be equipped with an eccentric or squeeze locking type collar arrangement to secure the bearing to the related shaft.
5. All bearings and exposed shaft ends at load conveyors, unload conveyors, shall be covered with bearing covers.

M. Hardware

1. Provide zinc plated or otherwise treated fasteners. Use washers, lock washers and nuts.
2. All fasteners in public areas are to be made of stainless steel as described elsewhere in these specifications.

N. Straight Belt Conveyor

1. Construct transport, queue, load, unload, incline and decline conveyors of components as specified previously.
2. Design each baggage handling belt conveyor with a length to width ratio less than 2.5 with special tracking provisions to ensure positive belt tracking.
3. The maximum length of a straight belt conveyor shall be 60' unless otherwise shown in the contract drawings.

O. Ticket Counter Take-Away Conveyors

1. The end pulleys of the ticket counter take-away conveyors shall be such that there are no exposed gaps between the pulley and slider bed, nor shall it constrict the continuous gap between the belt edge and the guard (refer to “Head and Tail Pulleys” section of this specification for details on end pulley finger safety guards).
2. Bearings shall be installed on adjustable brackets.
3. Take-up and snub rollers shall be easily accessible and adjustable for belt tracking.
4. Bearings shall be pre-lubricated (grease-packed) and sealed for life.
5. The drive unit shall be of the center drive type.
6. All equipment with exposed surfaces visible to the public shall be covered with Type 304 stainless steel with a #4 brushed satin finish uniform throughout, unless otherwise specified by the Architect or the Owner. Stainless steel in public areas shall incorporate smooth flush edge seams. Radius type edges are not acceptable.

P. Checked Baggage Screening Area Load and Unload Conveyors

1. The end pulleys of the load and unload conveyors in the Stand-alone EDS area shall be such that there are no exposed gaps between the pulley and slider bed, nor shall it constrict the continuous gap between the belt edge and the guard (refer to “Head and Tail Pulleys” section of this specification for details on end pulley finger safety guards).
2. Bearings shall be installed on adjustable brackets.
3. Take-up and snub rollers shall be easily accessible and adjustable for belt tracking.
4. Bearings shall be pre-lubricated (grease-packed) and sealed for life.
5. The drive unit shall be of the center drive type.
6. All Load and Unload conveyor segments within the Stand-alone EDS area shall be covered with a painted steel shrouding, uniform throughout on both sides of the conveyor segment. Additionally, on the work aisle sides of the conveyor segments, provide an 8” high x 4” wide toe kick throughout the length of the conveyor segment(s), as illustrated in the contract documents. Construct shrouding toe kicks with 1/4" x 4" minimum steel flat stock and install so as to leave no gaps and with a ground smooth painted finish similar to the shrouding.

Q. Power Turns

1. All power turns shall be provided with a four (4) foot inside radius, unless otherwise noted on the contract drawings. All power turn support structures are to be of metal construction. Where multiple power turn segments are required to be installed butted together, provide them on a common (single)

Copyright © 2018 by BNP Associates, Inc. (BNP)

support frame assembly to simplify the overall installation and modify the mating ends of each power turn, as necessary and per the supplier's recommendations, so that the complete assembly between each segment closely fits together to minimize the transfer gaps at the junction points, which shall not exceed 1" (max.) between the belt face(s). Power turn shafts shall be 1-7/16" diameter 1018 TGP (turned, ground and polished) steel.

2. The conveyor system layout shall be designed to permit maximum radius power turns of 180° for flat power turns.
3. Ensure that the outside circumference side guard shall remain readily removable for maintenance. Ensure that no conduit or any other equipment is permanently fastened to it.
4. To minimize the gap between a power turn and straight conveyor, ensure the end rollers (both power turn and straight conveyor) are extended to gain a maximum gap of 1" between the faces of the belts.
5. Design the power turn conveyor so that trained maintenance personnel can easily replace belts.
6. Belt speed shall be measured on belt centerline.
7. Drive assemblies, bearings, and pulleys shall be designed as per straight conveyors detailed within this section of the specification.
8. If a power turn is installed prior to a 45° merge conveyor, the turn shall be equipped with a clutch/brake or VFD, as applicable, so that baggage queuing can be achieved on the turn.

R. Spiral Turns

1. All spiral turns shall be provided with a four (4) foot inside radius, unless otherwise noted on the contract drawings. All spiral turn support structures are to be of metal construction. Where multiple spiral turn segments are required to be installed butted together, provide them on a common (single) support frame assembly to simplify the overall installation and modify the mating ends of each spiral turn, as necessary and per the supplier's recommendations, so that the complete assembly between each segment closely fits together to minimize the transfer gaps at the junction points, which shall not exceed 1" (max.) between the belt face(s). Spiral turn shafts shall be 1-7/16" diameter 1018 TGP (turned, ground and polished) steel.
2. The conveyor system layout shall be designed to permit maximum radius spiral turns of 225° where the rate of incline or decline is less than or equal to 24" in 90° except as noted otherwise in the contract drawings.
3. Match side guard height with adjacent conveyors where rate of rise or fall is less than 12" per 90°. Provide 21" high side guards for other spiral turns with a greater degree of rise or fall.
4. Ensure that the outside circumference side guard shall remain readily removable for maintenance. Ensure that no conduit is fastened to it.
5. To minimize the gap between the spiral power turn and an adjoining straight conveyor, ensure the end rollers (both spiral power turn and straight conveyor) are extended to gain a maximum gap of 1" between the faces of the belts.
6. Limit rise or fall to a maximum rate of 24" in 90° except as noted otherwise in the contract drawings.
7. Belt speed shall be measured on belt centerline.
8. Design the spiral power turn conveyor so that trained maintenance personnel can easily replace belts.
9. Drive assemblies, bearings, and pulleys shall be designed as per straight conveyors detailed within this section of the specification.

S. Queue Conveyors

1. Provide queue conveyors of the manufacturers approved design capable of sustaining continuous stop/start operation at thirty – (30) cycles per minute under loaded conditions, without compromising a 60 bag per minute minimum processing rate for the associated subsystem in which the queue conveyor is installed.
2. Design the queue conveyors so that trained maintenance personnel can easily accomplish belt tracking.
3. Design of the queue conveyor shall be so that adjustments to belt tracking should only be required at a maximum of once every thirty (30) days.
4. Design, manufacture and installation of queue conveyors shall be in accordance with the design specifications of transport conveyors.

Copyright © 2018 by BNP Associates, Inc. (BNP)

T. 45° Merge Conveyors

1. Provide and construct merge conveyors with typical slider bed construction. Set drive/take-up unit at 90° to the flow of baggage. Run the belting over fixed 3-1/2" minimum diameter Schedule 40 pipe (or manufacturer's equivalent) and set at 45° to the conveyor centerline.
2. The drive motor shall be capable of a continuous operating capacity of 30 cycles per minute.
3. Design the merge conveyors so that trained maintenance personnel can easily accomplish belt tracking.
4. Design the merge conveyors so that trained maintenance personnel can easily replace belts.
5. Install merge conveyors with top of belt (TOB) 2" higher than that of the receiving conveyor to ensure smooth baggage transfer.
6. Merge shall be equipped with spring loaded, self-adjusting tensioners to prevent slippage and excessive noise.
7. Merge to downstream or "take-away" conveyor speed relationship must ensure that merged items are not skewed on the take-away conveyor.
8. Merge equipment design and speed must ensure the successful transfer of airline garment bag boxes or items of similar size onto the downstream or "take-away" conveyor so that there are no jam problems associated with the garment bag boxes at either that conveyor or any conveyors downstream of the merge. Install a minimum ½" wide brush (with holder arrangement) inserted between the merge and the take-away conveyor biased towards the downstream corner of the merge to eliminate potential snag points.
9. Merge conveyors, shall be fabricated by a qualified manufacturer, with previous installations in BHS applications. Final approval of the qualified manufacturer shall be at the discretion of the Owner or their Representative.

2.5 INCLINE PLATE/SLOPE PALLET MAKE-UP DEVICE

A. General

1. Incline plate/slope pallet devices shall be constructed of articulating contoured pallets or flights forming a continuous, rotating, sloped surface. They shall be arranged to receive baggage from a feed conveyor(s) at a point on the inside rim as shown on the contract drawings. The unit shall be automatically fed via belt conveyor(s).
2. The BHS Contractor as part of the bid proposal can submit their standard incline plate/slope pallet device specifications for review. Final approval of the qualified manufacturer shall be at the discretion of the Owner or their Representative. The design, manufacture, and installation of the incline plate/slope pallet device must conform to all sections of this specification as is appropriate.

B. Dimensions

1. The height of incline/slope pallet devices shall be as follows unless otherwise specified by the Owner or their Representative or shown on the Contract Drawings:

   a. Make-up devices: 29" – 33" above the work surface

2. The BHS Contractor can as part of the bid proposal, submit their standard incline plate/slope pallet device details for review and approval, if the height is different from those specified above.

C. Load Rating

1. All incline/slope pallet devices shall be capable of supporting a minimum dynamic load of 125 pounds per linear foot.

D. Operating Speeds

1. The device operating speed for incline/slope pallet devices shall be 90 fpm.
2. Incline/slope pallet devices shall be capable of accepting baggage per each in-feed conveyor at a rate of thirty – (30) bags per minute.

E. Drives

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. The drive shall consist of a heavy duty, double pitch roller chain driven by a motor through a gear reducer and drive sprocket. The roller chain shall engage at least two modular flight assemblies at all times. Connect motor and reducer-using double grooved sheaves and matched V-belts.
2. Each incline plate drive shall be equipped with an appropriately sized electronic soft start device.
3. The design of the drive motor circuitry shall provide that the related drive motor safety disconnect switches shall also open the control circuitry of the device whenever the disconnect switch is turned to the off position. Whenever, the disconnect switch is turned back on, it shall be necessary to reactivate the appropriate device start controls, thus allowing the drive motor start-up to be controlled by the soft-start controller.
4. A minimum of two drive units / two associated electronic soft start devices are required for all baggage make-up applications due to redundancy requirements. The incline plate device shall be designed and configured such that if one of the drive units should fail, the device shall continue to operate at 100% capacity including the ability to start-up under full load conditions with the remaining drive unit. Easy access and means for disconnecting failed drive unit shall be provided to allow for system maintenance with a minimum of time and effort. Drive design and motor applications must provide for the potential of variations in “actual” motor speeds so that the drive motors are equally loaded. The motor used in the dual drive units is to be of the “high slip” design type.
5. High-Slip Motors are required by specification where the use of dual drive units is used. These motors shall be copper-wound NEMA Design "D", Class "H" Insulation at 1.0 Service Factor with Class "F" temperature limits. Inverter Duty or Inverter Ready Motors shall be used at "VFD" controlled applications. These motors shall be copper-wound NEMA MG1, Part 31 Rated Design "B", Class "H" Insulation at 1.0 Standard Service Factor with Class "H" temperature limits. All motors shall be of the "high efficiency - low energy" type.
6. For ease of drive synchronization, variable frequency controllers are acceptable.
7. The device drive and idler shaft sprockets must be restrained through the use of double setscrews to prevent any lateral movement of the sprockets on the respective shafts. Setscrews alone are not sufficient.
8. Drives shall be designed for operation from a 480 VAC, 3-phase, 60 Hz power source. The drive shall be sized to permit start-up under full load conditions.
9. One 120 VAC, single-phase, 60 Hz duplex outlet shall be provided as a maintenance outlet in the general vicinity of each drive assembly.
10. The baggage system control circuitry must be designed to assure that the make-up device is running at full speed prior to the startup of any feed conveyors.
11. Install in close proximity to one of the drive units a control station with a Maint/Auto switch and a jog pushbutton for use by maintenance personnel only. When the switch is in the maintenance position, the device can move (jog) in the forward direction only when the jog pushbutton is held in.

F. Pallet/Flight Assemblies

1. Each flight assembly shall consist of a steel support assembly with upper support wheel, a flight (cover pan) and a segmented, molded rubber bumper at the lower end. Each module shall be connected at its lower end to a continuous device linkage, which incorporates the lower support wheels. Upper and lower support wheels shall have polyurethane treads for quiet operation of the device. Flights shall be 14-gauge stainless steel with Teflon tape rub strip applied to the underside of each flight at the trailing edge to prevent scratching or scoring of pallets.

G. Frame and Track

1. The frame shall consist of standard modular assemblies bolted together to form a support structure and guide for the flight assemblies. The track shall be of rolled or formed structural steel. Structural supports for the tracks are to be spaced on a maximum of 4' centers.
2. Once the structure of the device has been installed and properly aligned, all track joints and cam follower guide rail joints shall be welded and ground smooth to assure that the related track and guide surfaces are smooth and without vertical and horizontal differences.
3. The design of the incline plate device shall incorporate a means of expansion of the device to offset any wear in the main link bushings/connecting link pins or similar components.

Copyright © 2018 by BNP Associates, Inc. (BNP)

4. The design of the means of device expansion shall include, at a minimum, the following items:

   a. Overlapping design of the cam follower guide track so that the cam follower surface is always in contact with some portion of the guide track at the expansion joint.
   b. Heavy-duty jacking-bolt arrangement to assist in expanding the device when needed.
   c. Special attention is to be given to the design, manufacture and installation of the inner and outer perimeter finger guards as well as the vertical front face skirting at the expansion point.
   d. The design, manufacture and installation of the special expansion joint perimeter finger guards must assure that they do not create a snag point.
   e. To further reduce the potential of snagging baggage at these expansion joints, the special finger guards are to be welded and ground smooth on the upstream end of each of the special guards.

H. Finish and Trim

1. Baggage Make-Up Applications

   a. For sortation/baggage make-up applications in non-public areas, outer peripheral guards and trim strips shall be steel finished in wear and rust resistant gloss paint. As an alternative, a rust-resistant powder coat finish may be applied electro-statically to said surfaces. A 3" high toe space shall be provided at the base of the peripheral guards. The toe space kick plate shall extend to the finished floor.
   b. All steel trim elements must be properly aligned vertically and horizontally. Butt joints of adjacent trim elements must provide a smooth snag free surface. Voids between adjacent elements at the joints are not acceptable. Sharp edges on any of the trim elements are not acceptable. All radii of trim elements must match.
   c. The vertical and horizontal alignment of the adjacent butt joints of the finger/perimeter guards of the device must not be misaligned nor is there to be any gap between the adjacent guards.
   d. Side Guards

      1.) Incline plate/slope pallet make-up devices shall have a 12" inner perimeter back guard for the entire inner perimeter. It shall be butt jointed and bolted to the in-feed conveyor side guards so there are no snag points. The bottom of the guard shall be no more than 1/4" above the pallets/flights.
      2.) The inner perimeter bag guard must be designed and installed to provide a means of diverting baggage on the device away from the transition plate of any in-feed conveyors so that this baggage does not jam or snag on the plate. This is to be accomplished with a flaring of the bag guard immediately upstream of the transition plate.

   e. Finger Guards

      1.) A finger guard consisting of 6", minimum 12-gauge steel formed angle stock side rails shall be installed. The 6" total width of the finger guard shall overlap the pallets by 3" and shall overlap the outer radius of the turn when the pallet is bent at a 90° turn. The gap between the pallets and the finger guard shall not exceed 3/32". The vertical and horizontal alignment of the adjacent butt joints of the finger guards must not be misaligned, nor is there to be any gap between the adjacent guards.
      2.) Special attention is to be given to the design, manufacture and installation of the steel inner and outer perimeter finger guards as well as the vertical front face skirting at the expansion point of the incline pallet device.
      3.) The design, manufacture and installation of the perimeter finger guards at the device expansion points must assure that they do not create a snag point. To further reduce the potential of snagging baggage at these expansion joint locations, the finger guards are to be designed and installed in an overlapping manner. The overlapping finger guards are to be welded and ground smooth on the upstream end of each expansion joint location.

   f. Transition Plate

Copyright © 2018 by BNP Associates, Inc. (BNP)

1.) A transition plate shall be designed and installed at the discharge end of each in-feeding conveyor and provided with angled sides as illustrated in the accompanying drawing package for a smooth snag-free transfer of baggage onto the device. Special care must be taken in the design and installation to ensure re-circulating baggage on the device shall not be damaged or snagged by the plates. The discharge end of the plate should be extended and aligned with the inner perimeter back guard, which shall be installed past the outside edges of the slope pallets.

g. Back Stop

1.) A back stop shall be designed and installed on the outside radius of the make-up device opposite the discharge end of each in-feeding conveyor as illustrated in the accompanying drawing package. Special care must be taken in the design and installation to ensure re-circulating baggage on the device shall not be snagged by the back.

2.6 RELOCATION OF EXPLOSIVE DETECTION SYSTEMS – REVEAL CT80DR AND CT80XL

A. TSA Equipment Responsibility

1. The existing EDS and ETD equipment, including the associated Field Data Reporting System (FDRS) computer terminals, the EDS machine Baggage Viewing Station (BVS) with related Uninterruptable Power Supplies (UPS), roller-bed conveyors, and stainless steel tables/workstations will be relocated/reconfigured by the TSA's Contractor; this scope will also include all associated rigging and site acceptance testing of the EDS machines. The TSA will also provide all new roller-bed conveyors and new pedestals (if needed) to facilitate the proposed TSA baggage screening work areas that are illustrated in the contract documents.

B. BHS Contractor Responsibility

1. Coordinate the placement of the EDS equipment in its final location, with the TSA's Contractor, by marking the exact location (e.g., centerline markings) of the EDS machines, and ensure proper alignment/positioning with the respective conveyor subsystem. The BHS Contractor shall be present during the placement and installation of the EDS equipment to ensure proper alignment with adjacent roller-bed conveyors and BHS equipment.

2.7 MISCELLANEOUS MECHANICAL EQUIPMENT

A. Catwalks

1. Provide as a minimum, the maintenance catwalks as located on the Contract Drawings and as required to ensure safe access for all personnel who operate, maintain or have access to the BHS in compliance with the applicable requirements of OSHA and NFPA 101 Life Safety. All catwalks used as a means of egress shall meet life safety requirements for guardrails and handrails. The BHS Contractor shall be responsible to coordinate with the Owner or their Representative to confirm the final number and locations for all maintenance catwalk right-of-ways, along with the associated stairs, ladders, and crossovers.
2. Design, provide and install all maintenance catwalks and access ladders required to allow easy access to BHS equipment by the Owner's O&M group. Submit to the Owner the design of the catwalks with associated access ladders, stairs, and crossovers for review and approval.
3. Include personnel protection at all catwalks to ensure that any potential injury is minimized. This includes swing gates or off-sets at access locations per OSHA standards 1910.23, padding, rounded corners, smooth welds, deburred surfaces and any other measures as may be necessary.
4. Attach all catwalks to the support structure, whether using decking of sheet steel using stitch welds every 24" (or open steel grating (Ry-Weld 19W4 or approved equal) per BHS Bid Alternate) or as dictated by OSHA standards. Coordinate the type of catwalk deck (solid or open grate) with the Owner or their Representative and the Project Architect to ensure fire code/protection measures and lighting considerations are complied with. As part of the coordination efforts, at a minimum provide

Copyright © 2018 by BNP Associates, Inc. (BNP)

a price for both options (solid or open grate) for the Owner's review and consideration per the accompanying BHS Price Schedule spreadsheet.

5. Design catwalks to provide adequate space for operating and maintenance personnel.
6. Design structure to limit the deflection to 1/360 of the unsupported span length, under a concentrated 300-pound load.
7. Design all catwalks capable of supporting a minimum uniformly distributed live load of 40 pounds per square foot and a dead load of 25 pounds per square foot (total load of 65 pounds per square foot). The use of pan type catwalks constructed of #12 gauge hot rolled steel is acceptable if coordinated with and accepted by the Owner.
8. Notch the decking where needed to clear obstructions. Add angle clips as required to maintain adequate support of notched structure.
9. Where lengths of decking are butted end to end, ensure that the joint falls on a structural cross member.
10. Securely weld all pieces of decking to the catwalk frame and all structural cross members.
11. Any catwalks with inclines of up to 8° shall be equipped with an anti-skid walking surface. Catwalks with inclines of more than 8° shall be equipped with steps as well as the anti-skid material.
12. Provide steps at all locations where there is an elevation change in excess of 8". Paint the step "yellow".
13. Minimum catwalk width shall be nominally 48", where possible, but not less than 36" with a 3" gap between the conveyor and the catwalk.
14. Unless otherwise noted on the drawings, the top of catwalk shall be installed 8" below the top of belt at the intermediate section of the conveyor (between drive sections) and 15" below the top of belt at the drive sections.
15. Design and installation of access into the conveyor catwalk areas shall not be less than a 36" wide by 44" high, clear access envelope, to allow fire fighters with breathing apparatus enough room to climb up to and access the catwalk area.

B. Crossovers

1. Provide the below outlined functionality at all crossover access stairs, ladders, catwalks, handrails, swing gates and similar such hardware to provide a complete, safe and operable crossover.
2. Provide a request access pushbutton control station located at each access point to the crossover that includes the following control devices:

    a. Request Access Green Pushbutton.
    b. Release Access Red Pushbutton.

3. For Crossovers with ships stairs, provide the bi-directional swing gate with interlocks to the e-stop circuit. Hinge the swing gate so as not to block egress when opened in either direction.
4. The associated crossover PLC shall inhibit the normal startup procedure while the equipment is in "Crossover mode".
5. Provide a stack light mounted on a stanchion at each crossover location. Sequence of operations as follows:

    a. Normal Sequence of operations shall be as follows:

        1.) In normal mode, when not in active crossover mode, the red stack light shall not be illuminated.

    b. An operator will request access by pushing the request access pushbutton which will cause the following to occur:

        1.) Request red stack lamp shall flash at 2Hz until safe to access.
        2.) The conveyor immediately upstream of the conveyor under the crossover shall stop. All other upstream conveyors will cascade stop if the associated conveyor photocell is blocked.
        3.) The conveyor under the crossover shall run for its length and then stop.
        4.) The conveyor immediately downstream of the crossover shall stop once the conveyor under the crossover stops.
        5.) The red light in the light stack shall illuminate solid.

Copyright © 2018 by BNP Associates, Inc. (BNP)

6.) The operator opens the gate, crosses the crossover, opens and closes the gate on the opposite side of the crossover.
7.) The operator presses the release access pushbutton causing the red light in the light stack to flash at 2 Hz for 10 seconds (configurable).
8.) After 10 seconds, the red light in the light stack extinguishes.
9.) The conveyors starts up again after 5 second start-up warning alarm (duration to be configurable).

6. In the event one of the gates is open when the release access button is pressed, the operation shall be ignored by the control system (and an audible alarm sounds). The release access pushbutton can only activate the release access sequence if all gates are closed.
7. In the event the release access pushbutton is not activated within 2 minutes (configurable) after initial activation of the request access sequence, an alarm message shall be displayed to the PC Fault Diagnostics Workstation and MCP Touchscreen Display and the red illuminated stack light (and an audible alarm sounds) shall flash at 3 Hz. In order to reset this condition, the release access pushbutton must be activated at the crossover.
8. The swing gates shall not activate an e-stop circuit if the normal sequence of operations is followed as per above.
9. In the event the normal sequence of operation is not followed, and a swing gate is opened, an emergency stop shall be activated, the conveyors in the zone under the crossover shall be stopped and can only be reset from the e-stop reset pushbutton at the location of the crossover.
10. The current mode and all sensors and lights in the crossover shall be indicated on the PC Fault Diagnostics Workstation and MCP Touchscreen Display. As a minimum, the following modes shall be indicated:

    a. Normal Mode – Green.
    b. Crossover Mode – White.
    c. Release Access Fault Mode – Flashing Red.
    d. Fault – Red.
    e. The PC Fault Diagnostics Workstation shall report how many times a day the crossover was operated and the total time the conveyor was stopped due to the crossover operations.

C. Toeboards

1. Provide toeboards on both sides of all catwalks 24" or more above the finished floor except where adjacent equipment or building structure provides the required function. Construct toeboards of 1/4" x 4" minimum steel flat stock and install so as to leave no gap between the catwalk walking surface and the lower edge of the toeboard. It is acceptable to use # 12 gauge rolled steel 4” high toeboard if the toeboard is not being used as an integral portion of the catwalk frame or structure. Securely weld toeboards to vertical handrail posts and to the access way support structure.
2. Design toeboards in accordance with OSHA standards.
3. Toeboards shall be painted “yellow”.

D. Handrails

1. Provide handrails around all catwalks more than 24" above the adjacent floor and on all stairways. Design handrails to withstand a minimum load of 200 lbs. applied in any direction at any point on the top rail. Vertical support posts shall be spaced not more than 8' on centers. Make handrails continuous.
2. Design all handrails to consist of a top rail with one intermediate rail positioned halfway between the top of the walking surface and the top of the top rail as per OSHA code of Federal Regulation Part 1926.500
3. In areas of restricted clearance (vertically or horizontally), make intermediate rails spanning across conveyor drive locations removable for drive maintenance access.
4. Close all open handrail ends, vertical or horizontal, by welding a metal cap.
5. Grind smooth all handrail welds.
6. Handrails shall be painted “yellow”.

E. Maintenance Ladders

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. Vertical Fixed Maintenance Ladders

    a. Provide fixed, 90° ladders to reach catwalks as required to ensure safe access for all personnel who operate, maintain or have access to the BHS. The BHS Contractor shall coordinate with the Owner or their Representative to confirm the final number and location for all maintenance access ladders.
    b. Design ladders to meet or exceed OSHA standards, section 1910.27 and 1910.23.
    c. All fixed ladders shall be of steel construction.
    d. The distance between rungs shall be no more than 12" and shall be uniform throughout the height of the ladder. All rungs shall have a minimum diameter of ¾" and shall withstand a 400-pound load when in use. All rungs shall be a minimum of 24" wide. The live loads imposed by personnel occupying the ladder shall be considered to be concentrated at such points as shall cause the maximum stress in the structural member being considered.
    e. Grind smooth all rough surfaces and edges.
    f. Side rails shall be of such cross section as to afford adequate gripping surface without sharp edges or burrs; the use of the C-Channel is not acceptable.
    g. Allow a minimum of 7" between the back of the ladder and the nearest permanent object. Allow a minimum of 30" between the front of the ladder and the nearest permanent object. Allow 16" from the center of the ladder to the nearest object on each side. The step-across distance from the nearest ladder edge to the nearest equipment or structure edge shall be a minimum of 2½" and shall not exceed 12".
    h. Provide both safety ladder hand bars per OSHA requirements and swing gate (s) at the top of all ladders.
    i. Provide fixed vertical ladders with handrails from top to bottom in accordance with OSHA section 1926.500 and 1926.501.
    j. Paint all fixed vertical ladders in “yellow” and provide a non-skid safety tread finish at the top and bottom landings.

2. Ship’s Ladders

    a. Provide fixed maintenance ship’s ladders to access catwalks as shown on the Contract Drawings. Provide additional maintenance ladders as required to ensure safe access for all personnel who operate, maintain or have access to the BHS. The BHS Contractor shall coordinate with the Architect, the Owner or their Representative to confirm the final number and locations for all ladders.
    b. Design ladders to meet or exceed OSHA standards, section 1910.27 and 1910.23.
    c. Provide serrated modified steel treads a minimum of 6 in. by 3.0 pounds per linear foot channel 30 in. long (unless noted otherwise in the Contract Drawings) covered with non-skid safety tread finish. The live loads imposed by personnel occupying the ladder shall be considered to be concentrated at such points as shall cause the maximum stress in the structural member being considered.
    d. Provide steel stringers using minimum 7 in. by 4.72 pounds per foot channel.
    e. Design ladder so that the angle between the stringer and the floor is not less than 60° and not more than 65°.
    f. Make the distance between treads a maximum of 12 in. The distance between treads shall be uniform throughout the height of the ladder.
    g. Provide handrails on both sides using 1-1/4 in. by 1-1/4 in. by 1/8 in. aluminum tubing.
    h. Provide protective measures (i.e. swing gate or off-set) at the top of the ship's ladder.
    i. Grind smooth all rough surfaces and edges.
    j. All ship’s ladders shall be of steel construction as specified elsewhere in this document.
    k. Provide ship’s ladders with handrails from top to bottom in accordance with OSHA section 1926.500 and 1926.501.
    l. Paint all ship’s ladders in “yellow” and provide a non-skid safety tread finish at the top and bottom landings.

3. Swing Down Aluminum Ladders

    a. Provide Swing Down Aluminum Ladders to access catwalks as shown on the Contract Drawings. The landing or top of the ladder should be adjacent to the associated catwalk not

Copyright © 2018 by BNP Associates, Inc. (BNP)

a part of it. Provide additional maintenance ladders as required to ensure safe access for all personnel who operate, maintain or have access to the BHS. The BHS Contractor shall coordinate with the Architect, the Owner or their Representative to confirm the final number and locations for all ladders.

b. Swing down ladders are to be of Type 1A, 300 pound capacity extra heavy-duty aluminum construction.
c. Provide serrated aluminum steps. The live loads imposed by personnel occupying the ladder shall be considered to be concentrated at such points as will cause the maximum stress in the structural member being considered.
d. Provide 3-inch wide I-beam side rails.
e. Design ladder so that the angle between the side rails and the floor is not less than 60° and not more than 65°.
f. Make the distance between treads a maximum of 12 in. on center. The distance between treads shall be uniform throughout the height of the ladder.
g. The minimum inside clear width for a swing-down aluminum ladder shall be 30”
h. Provide lifting mechanism, counter balance, and pulleys to hold ladder in the up position when not in use. The ladder should be stable either in the up or down position due to the counter weight without requiring any tie off or similar.
i. Provide protective measures (i.e. swing gate or off-set) at the top of the ladder.
j. Design ladders to meet or exceed OSHA standards, section 1910.26 and 1910.23.
k. Grind smooth all rough surfaces and edges.
l. Provide swing down aluminum ladders with handrails from top to bottom in accordance with OSHA section 1926.500 and 1926.501.
m. Provide swing down aluminum ladders with a small pull cord and counterbalance that is set up so that at no time is a force more than 2 lbs. required to either lift up, pull down or stop the ladder in mid motion. If such balance can’t be achieved, gas springs can be used as “assist” mechanisms to achieve the maximum required force requirement, but counterbalance shall still be required.
n. Swing Down Ladder Advisory/Warning Flashing Stack Light

1.) All swing-down ladders that are installed within a drive aisle area shall be provided with an advisory/warning stack light. Provide a failsafe interlock with associated swing down ladder consisting of the following equipment/controls:

a.) An Amber flashing stack light as a swing down ladder warning in the vicinity of each swing down ladder that will be visible to tug and cart drivers entering the immediate area of the respective ladder.
b.) Activation of the stack light shall occur as the swing down ladder is traveling from the full up position to the full down position and be maintained while in the down position.
c.) Deactivation of the flashing stack light shall occur when the swing down ladder is in the full up position.
d.) Power for the swing down ladder advisory stack light shall be obtained by means of a BHS Contractor provided step-down transformer connected to the line side of the MCP’s 480 VAC input power.

F. Fire Door (Powered)

1. Provide automated fire doors with related support frame at the locations illustrated in the contract documents. The installation of the fire doors (e.g., door, support frame and location) shall be coordinated with the conveyor right-of-ways, and any related conveyor enclosures, and shall be located so that they are aligned with the respective conveyor’s discharge end junction point so that they pass through the conveyor segments (the doors shall not close on top of the conveyor slider-bed). Take on the responsibility for the procurement, power and control design, mechanical and electrical installation of rolling shutter, slat-type, between-jamb-mounted and interior-face-mounted fire doors, including, as a minimum, the following features:

a. U.L. labeled hour rating to match fire partition walls where door is installed. For example, at 2-hour rated walls provide minimum UL labeled 2 hour rated doors. Obtain the proper fire

Copyright © 2018 by BNP Associates, Inc. (BNP)

rating from the Owner or Architect for all fire doors within the scope of the BHS Contract.

b. Electric Operator with 480 VAC, 3 phase, 60-hertz motor controller provided by the door manufacturer.

c. Up and Down limit or proximity switches connected to PLC input.

d. Provide a photocell or proximity switch to sense the door obstructions (e.g. detecting a bag under the door).

e. Fire/heat/smoke detectors located to sense approaching fire, heat or smoke source on the conveyor shall be provided by the Fire Alarm System Provider as per the specified requirements of Section 283111 (Digital, Addressable Fire-Alarm System).

f. Coordinate the facility fire zones with the Owner or their Representative and interface the BHS controls functionality of the fire door with the Fire Alarm System, so that if a fire is detected the respective subsystem will perform the necessary shutdown. Coordinate the spatial and access requirements within the PLC enclosure for these contacts with the Fire Alarm System Contractor. Provide the necessary relays for all subsystems with normally open dry contacts, mounted and wired to a terminal strip inside the PLC enclosure (i.e., inside the motor control panels whose PLC is controlling the conveyor subsystem that the fire door(s) is mounted on). Connect each normally open dry contact to the appropriate PLC I/O module. The contact(s) will be maintained closed by the fire-alarm system and open upon detection of a fire, heat or smoke condition to signal the requirement for closure of the fire door. As the fire door also serves as a security door, it shall open and close consistent with the respective subsystem start-up and shut-down sequence.

g. A 160°F fusible link which, when broken, shall cause the door to close automatically and report to the central facility security/fire system the status of the door (e.g., open or closed). All wiring between the BHS MCP and the facility central fire-alarm system for this reporting function shall be provided as required. Provide the appropriate interface within the MCP/PLC to accommodate this reporting controls function and coordinate the interface requirements with the Fire Alarm System and Building Access Control System Contractors.

h. A means for manual operation. If operation is accessible from one side only, select the side offering the most danger should the door close and block a potential exit.

i. The door is to be equipped with an externally mounted limit or proximity switch. The limit or proximity switch shall be mounted in such a manner so that the "fully open" position of the door is sensed. If the door is sensed by the limit or proximity switch not be in the fully open position, the associated conveyor shall be stopped if running or shall not be permitted to start if the conveyor was not already running. Note that this limit or proximity switch is in addition to those limit switches provided with the door operator if the door is powered.

j. Provide all stainless steel trim elements around door openings for public spaces and painted steel trim elements for non-public spaces. Coordinate the trim requirements with the Owner and Architect.

k. Coordinate installation and framing of the fire door(s) with the Owner, Architect and other contracts.

l. Clearly define by way of detail plans and elevations (on the submitted mechanical drawings) all of the required operational and maintenance clear zone requirements in order to avoid any obstructions with other trades involved in building construction.

m. Coordinate the testing of fire doors with the Owner or their Representative, the fire system installation contractor and the appropriate authorities.

n. All fire doors that are directly associated with BHS shall be installed perpendicular to the conveyor centerline. Coordinate installation and framing of the fire door(s) with other contracts.

o. The design of the fire door control system is described in the BHS “Special Control Requirements” section of this specification (Part 3).

G. Security Door (Powered)

1. Provide BHS security doors with related support frame at the locations illustrated in the contract documents. The installation of the security doors (e.g., door, support frame and location) shall be coordinated with the conveyor right-of-ways, and any related conveyor enclosures. The mechanical and electrical installation, power and control of rolling shutter, slat-type, between-jamb-mounted

Copyright © 2018 by BNP Associates, Inc. (BNP)

and interior-face-mounted security doors, shall include as a minimum, the following features:

a. Electric Operator with 480 VAC, 3 phase, 60-hertz motor controller provided by the door manufacturer.
b. Provide a photocell or proximity switch to sense door obstructions (e.g. detecting a bag under the door).
c. The door is to be equipped with an externally mounted limit switch, photocell or proximity switch to sense door position connected to PLC input. The limit, photocell or proximity switch must be mounted in such a manner so that the "fully open" position of the door is sensed. If the door is sensed, by the limit switch, photocell or proximity switch not be in the fully open position, the associated conveyor shall be stopped if running or shall not be permitted to start if the conveyor was not already running. Note that this limit switch, photocell or proximity switch is in addition to those limit switches provided with the door operator if the door is powered.
d. Provide all stainless steel trim elements (around door opening) for those security doors located in public view and painted steel trim elements for non-public spaces. The BHS Contractor shall coordinate the trim element requirements with the Architect, the Owner or their Representative. Subsystem security doors shall open and close consistent with the respective subsystem start-up and shut-down sequence.
e. All security doors that are directly associated with the BHS shall be installed perpendicular to the conveyor centerline. The BHS Contractor shall coordinate installation of the security door(s) with other contracts.
f. The design of the security door control system is described in the BHS “System Control Requirements” section of this specification (Part 3).
g. Control Requirements” section of this specification (Part 3).

H. Non-Powered Portable Gravity Roller Bed Conveyors

1. Provide non-powered portable gravity roller bed conveyor to allow for the smooth transport of baggage between the TC1 runout conveyors and the EDS machine entrances as well as from the EDS machine exits to the OT1 load conveyors.
2. Construct the bed section using 4” steel channel. Cross bracing shall be 1-1/2" angle stiffeners welded to the underside of the bed at a maximum center distance of 2' - 3'.
3. Provide 1.9" diameter spring loaded return galvanized rollers equipped with hex shafts to be located on 2" centers. Each roller shall be equipped with sealed, permanently lubricated, maintenance-free bearings.
4. Design of the flip up bed section is to be hinged. The folding section shall be capable of rotating 90° up into a locked position so as to provide a walk path.
5. The first three rollers adjacent to a powered conveyor shall be of a “breakaway” design with non-captured shafts that will easily dislodge from their normal position in the event an object is forced between the moving conveyor and the rollers.
6. Captured rollers shall have spring loaded hexagonal shafts to allow quick replacement.
7. Each roller shall be able to withstand load of 100 lbs. without permanent deformation or damage to bearings or shaft.

I. Draft Curtains

1. Provide draft curtains at all BHS related wall and floor penetrations between conditioned and non-conditioned, conditioned and tempered, or tempered and non-conditioned spaces.
2. Construct the draft curtains with two staggered layers of black 8" wide anti-static vinyl (PVC) strips. Each strip shall be 0.080” (minimum) thick at center and include a 0.120” (minimum) thick beaded outer edges, installed with a 50% overlap (i.e., staggered strip layers) to create a barrier between the two spaces for dust and temperature control.
3. Provide stainless steel trim around wall openings for public spaces plus at the stainless steel oversize slide location and painted steel trim for non-public spaces. Coordinate these draft curtain trim requirements with the Owner or their Representative.

J. Conveyor Impact Protection

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. Provide impact protection as located and detailed on the drawings and as required to adequately protect MCPs, ship's stairs, ladders, conveyors, the oversize slide and the make-up device. Construct the impact protection and supports of structural steel, heavy walled sections in shapes as indicated. Securely fasten all impact protection components to each other and to the floor.
2. Field verify, all dimensions shown on the drawings to insure proper fit with the equipment system interface.
3. Ensure that the impact protection is able to withstand the impact of a fully loaded vehicle (tug and cart) when backing into position at a speed of 2 miles per hour.
4. Apply primer and then one coat of "yellow" paint to all impact protection steel members that are not exposed to the weather (e.g. within the bag room).
5. Design impact protection so that maintenance access to the protected equipment is not restricted.

K. Slides

1. Construct slides of minimum 10 gauge stainless steel with welded joints, formed and reinforced as required to resist deforming from the effects of manual loading. Remove rough spots and scale by grinding or filing to prevent snagging of baggage or tags.
2. In the event that joints shall occur in the slide surface the upper sheet shall be lapped over the lower sheet (in the direction of baggage movement).
3. Design to allow a dynamic load of 50 pounds per square foot over the entire slide surface. No local deformation shall occur with a concentrated load of 150 pounds per square inch at any point on the slide.
4. Provide and install full-length side guards on both sides of all slides. Such guards shall be a minimum of 12" high above the slide surface with a rolled or formed top edge, a minimum of 3/4" thick, to afford stiffness to the guard panel.
5. Fasten side guard to the slide with bolts or by welding. Protrusions shall not be permitted on the inside surface of the guard. Employ vertical stiffening support brackets a maximum of 2' on center on the outside of the side guards.
6. The charge end of the slide shall be mounted so that is 1" below the adjacent belt height of the associated main conveyor subsystem.
7. Slide side guards or slide surfaces shall not deform or unduly deflect as a result of baggage impact by manual loading.

2.8 SPECIAL MECHANICAL EQUIPMENT REQUIREMENTS

A. General

1. Ensure that the design and installation of all conveyor equipment provides maximum access for operation and maintenance personnel.

B. Baggage Over-height Restriction Bars

1. Over-height restriction bars shall be installed on all conveyors equipped with over-height detection photocells, (i.e. at the ticket counter inputs and outbound transport bag load conveyors). These bars shall be set at the appropriate height to restrict passage of baggage exceeding the maximum bag height requirements for those specific locations. In all cases, the over-height bar support structure may be used for mounting of the over-height detection photocell. For over-height restriction bars to be placed on public area load belts, coordinate whether the restrictor bar is installed on the public or secure side, and design of the over-height restriction bar with the Owner and the Architect to ensure sufficient height measurement as well as material type (and shrouding, if necessary) in consideration of the associated fire/security door.

2.9 ELECTRICAL TECHNICAL REQUIREMENTS

A. Electrical Service to be Provided by the BHS Contractor

1. Power for the various subsystems shall be provided via the BHS Motor Control Panels, which shall feed the BHS related conveyor field components as illustrated on the Contract Drawings. The power

Copyright © 2018 by BNP Associates, Inc. (BNP)

supply to the BHS Motor Control Panels shall be provided by Division 26 and shall consist of conduit and cable in an appropriately sized junction box (supplied and installed in accordance with the requirements of Division 26) connected at its source to an appropriately sized circuit breaker located at the building substation panel or facility power distribution panel as specified under Division 26. The power drop to the 480VAC BHS Motor Control Panels shall terminate with approximately 20' of coiled cable at the BHS Motor Control Panel locations. The full load ampacity rating (FLA) shall be as indicated on the contract drawings (it shall be the BHS Contractor's responsibility to verify the FLA requirements and notify the Owner or their Representative of any increase/decrease). Supply power shall be 480 volts, 3 phase, their 60 hertz. Verify and advise the Owner or their Representative that the ampacity at the PDP is sufficient for the requirements of the system.

2. Provide and install all necessary conduits and wiring, including transfer switches (if required) from the various MCPs and onward to the BHS field equipment/components, as necessary to meet requirements of the specification. Size feeders from the power drops at 1.25 times the minimum NEC (or applicable local code) permitted size for the full-load amperage required including providing power to the screening machines.
3. Provide power for the MCP's 120 volt, NEMA 5-20R grounded receptacle, fused to 3A, and MCP's lighting by obtaining the BHS 120-volt supply via a transformer and a separate disconnect, connected to the line side of the 480-volt input power.
4. Provide and install all services, feeders and disconnect switches for branch circuits to each control panel, with separate circuits for each subsystem as specified and provide and install all panel boxes, wireways, conduits, conductors, transformers, breakers/fuses, and any other equipment and materials required to complete the electrical power distribution for the operation of the system. Refer to NEC Article 300 for wiring methods.
5. Provide an assessment for review and approval, identifying compliance with NFPA 70E Standards for Electrical Safety in the Workplace regarding the BHS MCPs that are part of this project and the need for personal protective equipment.
6. The BHS Contractor shall, during the engineering sequence, provide detailed power calculations for review and approval by the Owner or their Representative in an effort to reduce the MCP amperage provided and thereby reduce the power provided to the system. Coordinate the detailed power requirements including any reductions with the Owner or their Representative.
7. Provide separate circuits for controlling programmable logic controllers (PLCs), MCP Touchscreen Terminals, PC-type Computer Terminal Workstation , thermostatically controlled MCP/computer workstation cooling fans and powered fire/security doors. Note that these circuits shall originate within the respective MCP or computer workstation and be provided with UPS for backup and power conditioning.
8. Calculate the electrical power supply requirements on the basis of total connected load with a diversity factor. Size the conductors to ensure that the voltage drop does not exceed 3% at the farthest outlet of power, heating and lighting loads, or combinations of such loads. Also ensure that the voltage drop does not exceed 5% at the farthest outlet for both feeders and branch circuits.
9. Provide 120 volt, single phase, and 60-Hertz power for operation of the BHS control circuits.
10. Obtain the control power at each MCP by means of a transformer connected to the load side of the 480 volt input power.
11. All baggage systems that use programmable controllers shall be equipped with the appropriate number and size of power regulators to ensure that the power for the respective programmable controllers is properly conditioned. Regulators are to be of the type manufactured by the Sola Corporation (or approved equivalent).
12. All electrical components, devices, accessories, and equipment shall be listed, labeled and identified as suitable for use intended by testing agency acceptable to authorities having jurisdiction. This shall include MCPs and any control panels/cabinets, whether factory or BHS Contractor fabricated.

B. Power Source

1. All of the electrical equipment, computers and PLC control systems shall be compatible with, and operate reliably and effectively with, the normal electrical supply typically available at airport locations. The equipment shall not be unduly sensitive to fluctuations in supply voltage which may typically vary by plus or minus ten percent (10%) of nominal values.

Copyright © 2018 by BNP Associates, Inc. (BNP)

2. Provide necessary electrical supply filters, conditioners and regulators for all equipment, which cannot meet the specifications stipulated.

C. Raceways

1. General

a. Enclose all power and control wiring, including low-voltage wiring, in Galvanized Rigid Metal Conduit (RGS). Electrical Metallic Tubing (EMT) and Intermediate Metal Conduit (IMC) are not acceptable. Selection of raceways shall be in accordance with other sections of this specification and with Division 26 requirements.
b. In all unconditioned spaces, enclose all power and control wiring, including low-voltage wiring, in RGS due to corrosion considerations.
c. Horizontal runs of conduit shall not be supported by power turns, their safeguards, or by any side guard that is designated to be removable for the purpose of maintenance access. Rack such horizontal runs and support them from the building ceiling in locations not interfering with the BHS, maintenance areas, or catwalk areas. Local conduit/wireway runs between subsystem Motor Control Panels and BHS conveyor equipment shall be installed so that they follow their respective subsystem conveyor subsystem right-of-ways, without infringing on operational and maintenance access to conveyor equipment.
d. Install drops to motors or other devices adjacent to the nearest available equipment or building column, without infringing on baggage conveyance right-of-way edges where clearing of baggage jams will/may be required (e.g., conduits shall not be installed above the top edge of the conveyor sideguards).
e. Avoid conduit runs on the floor. Provide minimum clearance of 6" below horizontal conduit to the floor. The Owner or their Representative must approve exceptions to the above.
f. RGS Conduit runs shall be mounted so as not to restrict maintenance access to the BHS equipment, conveyors and system/conveyor components that required servicing.
g. Do not run communication, low voltage (less than 30 volts), or DC control wires in the same conduit, wireway or panduit with power wires.
h. It is acceptable to run 120 VAC minimum control wire and 480 VAC maximum power wire in the same conduit, wireway or panduit provided it is in conformance with local codes and VFD manufacturer's guidelines, as applicable.
i. Conduit runs shall not be run or mounted on outside guards or perimeter chain guards of power turns, or on merge conveyor deflector assemblies.
j. Conduit runs shall be mounted on unistrut using a two-piece unistrut strap or other means of fastening which is suitable for BHS applications as approved by the Owner or their Representative.

2. Galvanized Rigid Conduit (RGS)

a. Conform to all aspects of NEC for RGS (or applicable local code).
b. Use a minimum 3/4" for all wiring.
c. Run all conduits parallel or at right angles to structural members and equipment. Do not run conduits along or over the baggage conveyance right-of-way edges (e.g., over the top of the sideguards so as to maintain a clear zone for operational access, such as clearing of baggage jams and the like).
d. Do not run conduits underground or in floor slabs unless provided for that purpose by the Building Contractor.
e. In public areas, make conduit runs inconspicuous by running under cover plates, behind conveyors or otherwise concealed from public view.
f. In non-public areas, run exposed conduit in protected locations to prevent damage by moving vehicles, equipment or maintenance personnel.
g. Use malleable iron or steel threaded fittings.
h. Include gaskets and covers for all fittings.
i. Use standard threaded couplings at all conduit joints.
j. Ensure that the ends of the conduit are cut square, reamed and joined butt-tight.
k. Electro-galvanize all conduit, elbows, fittings, couplings and nipples.
l. Make changes to conduit size only at pull boxes, distribution panels, or branches to motors.

Copyright © 2018 by BNP Associates, Inc. (BNP)

Do not use reducers for in-line reduction of conduit size.

m. Remote control, signaling and power limited circuits shall be installed in compliance with NEC Article 725, (or applicable local code) as applicable.

n. Support conduit at intervals not to exceed 10'-0". Every individual conduit section shall be supported. Install conduit supported from building walls with a clearance of not less than 1/4" from the wall to ensure against the accumulation of dirt and moisture behind the conduit, using one-hole malleable iron clamps and clamp backs. For parallel conduit runs provide trapeze hangers or wall brackets fabricated from preformed channel with conduit clamps. Make anchors in concrete of the expansion shield type. Limit conduit run on a given conveyor to that, which is required for that particular conveyor or directly adjacent (downstream/upstream) to that particular conveyor.

o. Ensure that metallic and non-metallic motor disconnect boxes, wireway, control stations, outlet boxes, junction boxes, pull boxes and cover plates are compatible with the RGS conduit used and conform to the National Electrical Code (or applicable local code) for minimum wiring space requirements and material thickness. Provide all boxes with screw fastened covers. Use NEMA 12 enclosures for interior equipment. Use metal boxes; non-metal boxes shall not be used.

p. Appropriately sized insulated bushings and jumpers shall be installed on all conduits and conduit fittings that enter metallic MCP(s), workstation/computer cabinet(s), outlet boxes, disconnects, or j-box/pull box(es).

3. Flexible Metal Conduit

a. Conform to all aspects of the more stringent between this specification and NEC Articles 300 and 348 (or applicable local code) for flexible metal conduit and fittings.

b. Use liquid-tight flexible metal conduit for connection to motors, photocells, limit switches or any device, which may be subject to vibrations or require adjustment after installation. The use of non- liquid-tight flexible metal conduit such as “green field” is not acceptable.

c. Do not exceed 3' in length.

d. Every section of flexible metal conduit shall be clamped/supported.

e. Appropriately sized insulated bushings and jumpers shall be installed on all conduits and conduit fittings that enter metallic or non-metallic MCP(s), workstation/computer cabinet(s), outlet boxes, control stations, disconnects, or j-box/pull box(es).

f. Use minimum 1/2" for power wire.

g. Use minimum 1/2" for control wire.

D. Wire and Cable

1. General

a. Use stranded copper conductors of appropriate gauge, Type THHN or approved equal, with insulation rated for 600 volts. Use type XHHW only if required by code or the governing Airport Owner prohibits the use of PVC insulation. Conform to all aspects of the more stringent between this specification and NEC Code 376 and 378 or applicable local code.

b. Connect pre-wired electrical devices to terminal blocks mounted in junction boxes adjacent to the devices.

c. Do not use blade connectors (such as but not limited to fork or ring style) for connections.

d. It is acceptable to use multi-conductor cable for connecting portable electronic equipment. Refer to National Electrical Code (or applicable local code) for requirements on multi-conductor use.

e. Tag control and power circuit conductors with “machine” printed identification numbers at both ends of the wire. Tag method shall be of the sleeve or other permanent type submitted to and approved by the Owner or their Representative. The use of multiple tags to create a single tag is not acceptable.

f. Keep all wires on reels while being pulled. Do not allow wires to contact the ground or floor.

2. Minimum wire size

a.	Power	#12 gauge
b.	VFD Motor	#10 gauge (if individual wires are used in lieu of VFD rated

Copyright © 2018 by BNP Associates, Inc. (BNP)

cables and when allowed by VFD manufacturer's guidelines)

c. Control #14 gauge
d. PLC I/O #16 gauge (Connections between I/O modules and terminal strips inside MCPs)
e. Communication Circuits #18 gauge

3. Splicing

a. Splicing of 480VAC power wiring is unacceptable. All 480VAC wire pulls shall be from the MCP to the device (e.g. from MCP to the individual motor safety disconnect).
b. Splices are acceptable when parallel type connections are used for "hot" and "neutral" control wires (e.g. power wire for photocells, and e-stop circuits within a subsystem).
c. Do not splice signal wires between I/O panel and component.
d. Terminate control wires on terminal strips or on screw connectors at each component only.

4. Spare Conductors

a. Provide a minimum of 5% spare conductors in all conduit home runs, with a minimum of two spare control wires and one spare power wire.
b. Coil all spare conductors allowing sufficient length to permit future connection.
c. Tag spare conductors as required above, i.e., each spare conductor is to be identified as a spare with its own unique wire identification number and field termination location.

5. Wiring Identification

a. Color code all electric wire and cable as follows:

1.) MCP Power Wiring: Line Side

a.) Apply the following to all MCP power wiring from power source to line and load side of Main Disconnect fuses for MCPs. Verify color-coding of phase conductors on the line side to ensure compatibility with normal electrical supply available at the airport. Terminate the neutral, if applicable, at the terminal board:

Item	Wire Color
Phase A (480 VAC)	Brown
Phase B (480 VAC)	Orange
Phase C (480 VAC)	Yellow
Neutral	Grey
Mechanical Ground	Green

2.) BHS Field Components Power and Control Wiring: Load Side

a.) Apply the following to power and control wiring from the load side of fuses in MCPs to all devices that are powered and controlled from the respective MCP as follows:

Item	Wire Color
Power (To Motors and Control Transformers)	As dictated by local codes.
AC Control:	Red
DC Control:	Blue
AC Neutral:	White
Mechanical Ground	Green

Copyright © 2018 by BNP Associates, Inc. (BNP)

b.) Submit to the Owner or their Representative for review and approval the wire color method to be employed for this project.

E. Grounding

1. Ground all electrical equipment to building ground mat by a dedicated equipment-grounding conductor installed in accordance with the applicable codes. Obtain from the appropriate airport authorities, local codes or the Owner's Electrical Contractor the extent and type of grounding, wiring method and points of connection required.
2. Appropriately sized insulated bushings shall be installed on all conduits and conduit fittings that enter and exit the MCP or j-box/pull box.
3. Include a green 600V insulated copper ground conductor in each conduit (raceway).
4. Refer to National Electrical Code Article 348 (or applicable local code) for flexible metal conduit grounding requirements.
5. Refer to National Electrical Code Article 250 (or applicable local code) to determine grounding conductor requirements and sizes.

F. Support

1. Mount conduit supported from building wall using unistrut type mounting channels to provide clearance to the wall.
2. Do not weld conduit to structural members.
3. Avoid conduit runs to the floor. Provide minimum clearance of 6" between horizontal conduit and the floor and do not allow runs to cross any walk or access aisles.
4. Support cordsets running to items such as, but not limited to, photocells with cable mounting clips only. The cordset shall not be supported/secured with plastic wire ties.

G. Boxes

1. Provide outlet boxes, junction boxes, pull boxes and cover plates compatible with the conduit used. Provide boxes with screw fastened covers. Use NEMA 12 for interior equipment.
2. Conform to NEC Article 314 (or applicable local code) for minimum requirements for outlet boxes, junction boxes, pull boxes and cover plates.
3. Appropriately sized insulated bushings/seals shall be installed on all conduits and conduit fittings that enter/exit the box(es).
4. Unused openings in junction boxes, raceways, wireways, cabinets, and pull boxes shall be effectively closed to afford protection substantially equivalent to the wall of the equipment.

2.10 ELECTRICAL COMPONENTS

A. Wiring Devices

1. Provide full size oil-tight operators.
2. As much as possible, use the same type sensors (such as but not limited to photocells and limit switches) to minimize the number and type of spares. Select sensors with the same mounting system wherever practical.
3. Use plug-in type electrical components wherever available. Do not use blade connectors (such as but not limited to fork or ring style).

B. Control Devices/Stations

1. Control Device Locations

a. Control Stations and Control Devices shall be located as specified herein. All control station locations shall be coordinated with the Owner or their Representative. The location of the Control Stations and Control Devices is to be such as to provide maximum possible access to the Devices for servicing of the devices. For example, all Jam Detector and Head End Sensor Photocell devices are to be mounted so that they are accessible from catwalks adjacent to conveyors. In certain areas, protective guarding may be required to protect the

Copyright © 2018 by BNP Associates, Inc. (BNP)

Control Stations and Control Devices. However, the design and installation of this protective guarding must not prevent quick access to the control devices for adjustment, servicing or replacements.

b. The location, mounting and guarding of control stations and control devices must not in any manner restrict the access and servicing of any mechanical components of the BHS.

2. Control Device Mounting

a. The mounting of Control Stations and Control Devices, shall comply with the basic requirements established in the Contract Drawings and as noted in the following:

1.) Control Stations in Public View

a.) All Control Stations located in the view of the public shall be flush mounted with stainless steel cover plates. Such stainless steel cover plates must be secured to the adjacent wall or conveyor trim member with either Truss or Oval Head Phillips stainless steel machine screws of appropriate size. Control stations located in the view of the public shall not be mounted on the top surface of the conveyor front cladding. Pan Head screws are not acceptable.

b.) All Control Stations located in the view of the public at load conveyors (i.e. ticket counter conveyor control stations) shall be mounted on a stainless steel stanchion. Note that the design, manufacture and installation of the stainless steel shrouding on the collection conveyor must reflect these requirements.

2.) Control Stations in Non-Public View

a.) All Control Stations located adjacent to transport conveyors, on the incline plate make-up device and load/unload conveyors in non-public view shall be mounted on a Control Station mounting assembly.

b.) For load/unload conveyors in non-public view the control station shall be mounted on the horizontal portion of a Control Station mounting assembly bridging the load conveyor. Consider the "chording effect" of baggage at the discharge end of a horizontal load conveyor feeding onto an incline conveyor when determining the location of such an assembly. The vertical element of the assembly may also be used for the mounting and protection of head end photocells, if applicable.

c.) Design, manufacture and installation of the Control Station mounting assembly shall be such as to provide a "solid", well braced mounting for the related Control Station and Control Devices. Note also that the Control Station mounting assembly shall provide a minimum vertical bag clearance of 36" above the surface of the device. Reference the contract drawings for specific details.

3.) Control Devices

a.) All photocells shall be mounted in a vertical attitude with the LED photocell status indicator clearly visible to operation and maintenance personnel from the side of the associated conveyor or conveyor equipment. Photocells that are used for jam detection;, and the like are to be mounted so that the center of the photocell beam is 2.5” or 3” (must be consistent, e.g. all 2.5” or all 3”) from the top surface of the conveyor belt.

b.) Limit switches that are used to sense the position of Fire doors shall be mounted as an external unit to the door adjacent to the track of the door so that the switch can detect when the door is in the fully open position.

c.) Indicating lamps, other than those associated with MCPs, are to be located as required to properly alert personnel.

d.) Start-up warning alarms (i.e., audible and visual) shall be located at strategic locations to alert operations and maintenance personnel of the imminent start-up of conveyor equipment. As a minimum provide start-up alarms at baggage input areas, on top of the MCPs (or on the side of the MCPs in locations with reduced clearance), along the conveyor subsystem right-of-ways (e.g., ceiling

Copyright © 2018 by BNP Associates, Inc. (BNP)

supported conveyors.), runout conveyors, and at the make-up device location. Audible/Visual Fault Warning and Start-up Alarms may utilize the same control devices. However, the audible and visual indications shall differentiate between the two separate functions.

e.) Fault warning alarms (i.e., audible and visual) shall be appropriately located to alert operations and maintenance personnel of conveyor subsystem fault conditions. As a minimum provide fault alarms on top of the MCPs (or on the side of the MCPs in locations with reduced clearance). Audible/Visual Fault Warning and Start-up Alarms may utilize the same control devices. However, the audible and visual indications shall differentiate between the two separate functions.

f.) System Start-up and Fault Indication Flashing Stack Lamps: System start-up and fault indication flashing stack lamps, with amber lenses, shall be located on top of the MCPs (or on the side of the MCPs in locations with reduced clearance), at the baggage input areas, along the conveyor right-of-ways (e.g., ceiling supported conveyor equipment), runout conveyors, and at the make-up device location.

g.) Emergency Stop Switch Flashing Stack Lamps: Emergency Stop Switch flashing stack lamp with red lens shall be mounted on top of the associated subsystem MCP (or on the side of the MCPs in locations with reduced clearance).

3. Types of Control Devices

a. Pushbutton Units: All Momentary Contact Pushbutton units shall be of the Allen-Bradley Bulletin 800T series type (or Square D 9001K series or equivalent as reviewed and approved by the Owner or their Representative). The color coding for the Pushbuttons shall be as follows:

Function	Color
Start/Restart (non-public locations)	Green (flush head)
Normal Stop (non-public locations)	Red (flush head)
Alarm Silence (non-public locations)	Yellow (flush head)
Lamp Test (non-public locations)	Gray (flush head)
Others (non-public locations)	Black (flush head)
Motor Overload/VFD Fault (non-public locations)	Blue (flush head)
Open (non-public locations)	Black (flush head)
Close (non-public locations)	Black (flush head)

b. Illuminated Pushbutton Units: All Illuminated momentary contact Pushbutton units shall be of the Allen-Bradley Bulletin 800T - PA16 type units with guards (or equivalent as reviewed and approved by the Owner or their Representative). The color coding for the Pushbutton units shall be as follows:

Function	Color
Start (for initial startup conditions at public areas)	Green
Jam Reset	Amber
Emergency Stop Reset	Red
Over-Height/Over-Length Reset	White

c. Emergency Stop Pushbutton Units: All Emergency Stop pushbutton units shall be of the

Copyright © 2018 by BNP Associates, Inc. (BNP)

Maintained Contact, "Push to Stop" Illuminated Red Mushroom Head unit, Allen-Bradley 800T - FXP16RA1 Type 4/13 Push/Pull-Release (or Square D 9001K Series or equivalent as reviewed and approved by the Owner or their Representative). Note that the Emergency Stop Pushbutton units shall be equipped with a manual lockout clip manufactured by the manufacturer for locking the switch in the depressed position.

d. Selector Switches: All Selector Switches shall be of the appropriate series based on the application, as specified, and of the Allen-Bradley 800B type switch (or Square D 9001K Series or equivalent as reviewed and approved by the Owner or their Representative).

e. MCP Indicator Lamps

1.) Indicator Lamps shall be of the Allen-Bradley "Push to Test" Small Pilot Lights Bulletin 800T - PST16, (or Square D 9001K Series or equivalent as reviewed and approved by the Owner or their Representative) with appropriate color-coded lens as noted below for MCPs with less than five Indicator Lamps.

2.) For MCPs with five or more Indicator Lamps, a common Lamp Test Pushbutton shall be employed to test Indicator Lamps.

f. Emergency Stop Switch Indicator Lamps: For Emergency Stop Switch indicator Lamps adjacent to lanyard operated Emergency Stop Switches. Such Indicator Lamps are to be of the type manufactured by Crouse - Hinds, Cat. #BDA - 15GP, (or equivalent as reviewed and approved by the Owner or their Representative) with Red Globes.

g. Audible Warning Alarms

1.) Start-Up Warning Alarms for mounting at Ticket Counter Control Station, and at TSA Baggage Removal/Outbound Transport Load locations shall be of the Sonalert device as manufactured by Mallory Company Stock #64F278 Type SC250ER, or Allen-Bradley DEC/DEP Series alarm 855P-B10DEC22 for continuous tone or 855P-B10DEP22 for pulsing tone, to be determined by the Owner (or equivalent as reviewed and approved by the Owner or their Representative). For those Control Stations located in higher ambient noise locations, an alarm of appropriate higher frequency and dB rating shall be used (or equivalent as reviewed and approved by the Owner or their Representative). Selection must be made based on actual survey of the location.

2.) Start-Up Warning Alarms for other locations shall be of appropriate frequency and volume levels for the application location (such as baggage make-up areas and outbound transport subsystem areas). Such Audible Warning Alarms shall be as follows:

a.) Baggage Make-up Areas: Edwards Bell #340-6N5. Allen-Bradley 855H Series horn, Catalog Number 855H-BA10CD. Federal Bell #46-500-WB (or equivalent as reviewed and approved by the Owner or their Representative).

3.) Audible Fault Warning Alarms shall be of a horn type of appropriate frequency and volume level for the application location. Such Audible Fault Warning Alarms shall be as manufactured by Edwards Horn #876-N5, Allen-Bradley 855H Series horn, with Amber Beacon Catalog Number 855H-BCA10CDR5 or without Beacon 855H-BA10CD, or Federal Vibratone Horn #350-WB (or equivalent as reviewed and approved by the Owner or their Representative).

h. Audible/Visual Combination Alarms: Combination alarms for start-up or fault warnings mounted to MCPs, runout conveyors, make-up devices, or elsewhere as approved by the Owner or their Representative, shall be Allen-Bradley 855E Series with 120 VAC control.

i. Limit or Proximity Switches: Provide precision oil tight plug-in type limit switches with contacts rated for a minimum of 10 amperes continuous duty at 120 volts A.C. Limit switches that are used to sense the position of fire/security doors are to be mounted as an external unit to the door adjacent to the track of the door so that the switch can detect when the door is in the fully open position.

j. Lanyard Activated Switches

1.) Indexing Conveyors in non-public areas shall be equipped with a cable lanyard

Copyright © 2018 by BNP Associates, Inc. (BNP)

activated Index/Run Mode Switch that will change the index/accumulation mode of operation for an inch-and-feed conveyor to a run mode when the lanyard is activated. Release of the lanyard shall return the control function to the normal indexing accumulation mode.

2.) The design and location of the supports for the cable lanyard shall be provided as not to be easily damaged by baggage equipment or personnel.

3.) Run lanyard operated limit switches, used for the advancing of baggage on indexing accumulation conveyors such as the TC1-13 and -14 runout indexing conveyors in the TSA baggage screening area are to be mounted above the conveyor, mounted on the stanchions associated to the conveyor. The lanyard cable shall be supported with a minimum of heavy-duty 3/4" eyebolts.

4.) Systems that shall require the application of lanyard activated safety switches for either subsystem or system Emergency Stop Switches. Such Safety Switches must be of the "manual re-settable" type with padlock attachment as manufactured by Rees, Cat. #04944 - xxx, Conveyor Components Corporation, (or equivalent as reviewed and approved by the Owner or their Representative).

5.) Emergency stop lanyard operated limit switches and their associated lanyard cables are to be mounted along the catwalk or above the conveyor mounted on the stanchions associated to the conveyor.

6.) Lanyard cables are to be color coded as follows:

a.) E-Stop Lanyard Red
b.) Run Lanyard Green

k. Motor Safety Disconnect Switches

1.) Provide motor safety disconnect switches of the 3-pole, heavy-duty type, horsepower rated and non-fusible with a quick-make and quick-break operating mechanism and a means of padlocking the switch in the OFF position.

2.) Provide a N.O. auxiliary contact for connection to a PLC input.

3.) Motor safety disconnect switches for motors equipped with soft start devices must have an auxiliary N.O. contact interlocked with the associated emergency stop circuit.

4.) Each Motor safety disconnect switch shall be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the conveyor with which the motor is associated. Dymo - type labels are not acceptable. Attaching the ID plate to the safety disconnect door is acceptable.

5.) Use NEMA 12 enclosures for interior equipment.

6.) Clutch/Brake

a.) The 3 phase Motor Safety Disconnect is also to be used to interrupt the feed and neutral circuit to any externally powered electric clutch/brake device. The following describes how this shall be accomplished:

(1.) Provide 120 Volt AC power to the line side auxiliary contact in the Motor Safety Disconnect Switch (located at the motor) from the MCP.

(2.) Wire from the load side of the auxiliary contact of the Motor Safety Disconnect Switch (located at the motor) to the terminal strip in the respective MCP.

(3.) At the respective MCP, run two (2) parallel wires from the MCP terminal strip to the following:

(a.) One parallel wire from the terminal strip to the PLC input to indicate that the Motor Safety Disconnect Switch (located at the motor) is in the “ON” or “OFF” position.

(b.) The other parallel wire shall be the input voltage for the DC power supply that will supply DC power to the associated motor clutch/brake.

l. Fire/Security Door Safety Disconnect Switches

1.) Provide safety disconnect switches of the 3-pole, heavy-duty type, horsepower rated

Copyright © 2018 by BNP Associates, Inc. (BNP)

and non-fusible with a quick-make and quick-break operating mechanism and a means of padlocking the switch in the OFF position.

2.) Provide a N.O. auxiliary contact for connection to a PLC input.

3.) Each Fire/Security Door safety disconnect switch shall be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the door the disconnect is associated with. Dymo - type labels are not acceptable.

4.) Use NEMA 12 enclosures for interior equipment

m. Relays: Use general-purpose industrial, panel-mounted relays with convertible contacts rated at 10 amperes continuous current at 120 volts A.C. Ensure that all relays are capable of manual operation.

n. Timers: Provide solid state timers or utilize timer functions by PLC logic. All timers are to be mounted within the appropriate MCP. Use of timer devices within photocells is not acceptable.

o. Magnetic Motor Starters (NEMA)

1.) All motor control equipment shall comply with NEMA Standard ICS-1, ICS-2, UL publication 845 and other applicable standards of NEMA, UL, IEEE, ANSI, NEC and National Electrical Safety Code (or applicable local codes).

2.) Provide a separate magnetic motor starter unit for each motor drive section.

3.) Provide one auxiliary contact on each starter and wire to a PLC input module.

4.) Use size "0" starters for motors of 5 HP and below and size "1" for those above 5 HP. All starters are to be equipped with:

a.) Thermal overload protection on all poles.

b.) Overload relays of the manual reset type.

c.) Control voltage of 120 volts.

d.) Electrical and mechanical interlocks where required for reversing applications.

e.) Open type for panel mounting.

f.) NEMA 12 enclosure for general-purpose application.

g.) Overload relay shall be of solid state design.

p. Overload Heaters

1.) Size overload heaters for each NEMA starter in accordance with the full load current rating shown on the actual nameplate of each manufacturers selection tables.

2.) Each individual motor starter should be equipped with overload heaters.

3.) Provide a N.O. auxiliary contact for each overload relay for connection to a PLC input.

4.) Enunciate individual overload failure on the MCP Touchscreen Terminals and the BHS PC-type Computer Terminal Workstation fault reporting system.

q. Soft Start Devices

1.) Provide a soft start device for all drive units (i.e., each drive shall have its own soft start device) within the slope pallet baggage make-up device as recommended by the manufacturer. The use of a VFD device instead of a soft start device is acceptable.

2.) Provide an electrical/electronic soft start device with adjustable starting curve from 0 to 10 seconds for any conveyor drive equipped with a 7-1/2 horsepower motor or larger.

3.) Ensure that the electrical control circuitry design provides that the soft start device is always used whenever the associated drive motor(s) are started, regardless of start condition; i.e., regardless if drive motors are started with a control sequence or with activation of the related motor safety disconnect switch.

4.) The approved soft start devices, noted in the acceptable manufacturers listing, shall be sized for the specific application.

r. Electric Brakes

Copyright © 2018 by BNP Associates, Inc. (BNP)

1.) Provide brakes on all incline, decline, queue, indexing, and merge conveyors and for any other conveyors where coasting of the conveyor would be detrimental to the operation of the baggage system.
2.) Provide an electric brake for decline and incline conveyors that are equipped with a VFD. Wire the brake separately from the Variable Frequency Drive power source to prevent conveyor coasting.
3.) Provide dry friction, spring set, solenoid release type brakes integral with the drive motor.
4.) Incorporate automatic adjustment of brake disk wear or provide a brake, which requires minimal adjustment.
5.) Select the brake to be capable of cycling as required by the conveyor application under full load with no excessive wear.
6.) Choose brakes to have a minimum torque rating equal to the starting torque of the motor.
7.) Motor brakes that are installed on the end bell of the motors are to be equipped with an external means of "manual release" that would permit maintenance personnel to operate the motor in case of a failure of the brake.

s. Electrical Clutches

1.) Provide clutches on queue conveyors, merge conveyors, power turns feeding 45° merges, and on any other conveyors subjected to frequent start and stop operation with static torque not less than 1-3/4 times the full load running torque of the motor.
2.) When electric clutches are used with gear motors, construct the drive unit with the clutch between the motor and the input shaft of the reducer.
3.) Flange-mount the motor to an adapter housing in which the clutch shall be enclosed.
4.) Bolt the adapter housing in turn, to the gear housing.
5.) The motor-to-adapter and adapter-to-gear connections shall be kept in radial and angular alignment by means of machined and registered faces and flanges.
6.) The clutch shall be of a dry friction, disc type mechanical unit.
7.) The clutch shall operate on direct current, be of a simple design, have low power requirements and produce maximum torque during acceleration of the drive motor.
8.) Clutches shall be capable of permitting 60 engagement cycles per minute under full load with no objectionable heating or lining wear.
9.) Controls shall be the manufacturer's standard unit. Mount the clutch manufacturer's standard power supply in the Motor Control Panel (MCP) or local to the motor as reviewed with the Owner or their Representative. If the clutch controls or power supply are of a "plug-in" type, ensure that the device is equipped with a restraint clip to assure that the plug-in device does not loosen within its socket. Variation of starting torque shall be a feature of the controls and shall be accomplished by potentiometer in the clutch circuit.

t. Variable Frequency Drives (VFD)

1.) The use of a VFD shall only be permitted upon the review and approval of the Owner or their Representative. If VFDs are permitted to be utilized on the project, they shall comply with the following requirements.
2.) Type of VFD utilized shall be UL listed and IEC compliant.
3.) Provide a means of dissipating drive shaft voltages and bearing currents to ground for all conveyors which are provided with a VFD to prevent premature bearing failures.
4.) VFDs shall be typically installed within the respective Motor Control Panel (MCP). Factor in heat dissipation when designing the MCP and if excessive heat is anticipated from the braking resistors, then mount them in a separate NEMA 12 rated panel. To conserve MCP space, the BHS Contractor can propose to install the VFD remotely at the drive unit; however, the request shall be submitted as an alternate solution, and the Owner or their Representative must approve this type of configuration.
5.) Provide the ability to program and monitor all drive parameters. Provide programming devices with pre-programmed parameters for various types of VFD programs (e.g. standard queue, merge) to allow simple downloading of such programs

Copyright © 2018 by BNP Associates, Inc. (BNP)

when replacement or reprogramming of a VFD is required.

6.) Provide a local keypad control for start, stop, and speed reference functions.

7.) Provide dynamic braking resistors where required for faster stopping.

8.) VFDs shall be capable of permitting the appropriate number of engagement cycles per minute for the specific application under full load with no objectionable heating, overload tripping or other VFD faults. Factor this in when designing the system and provide VFDs and dynamic braking resistors of a larger power rating if required to meet the application's requirements.

9.) When using VFDs, either an approved method of wiring by the VFD OEM shall be provided or VFD rated shielded cable needs to be used. Use Belden, O'flex or equivalent cable. The shield should be connected to both the motor and the PE (Potential Earth) ground on the AC drive.

10.) For cable length of 50 ft. or more between the drive and motor, a minimum of 1 additional amp needs to be added to the drive rating to handle cable-charging current. For Cable greater than 100 ft. in length, a minimum of 2 amps need to be added to the drive rating for cable charging current.

11.) If the transformer which is powering the MCP is greater than 10 times the drive rating, an input line reactor shall be provided for each AC drive.

12.) Annunciate all individual variable frequency drive (VFD) failures on the fault reporting system. Automatic resetting of certain faults shall be permitted; however, all such faults shall be enunciated and logged regardless of whether or not they have been automatically reset.

13.) Submit to the Owner or their Representative catalog cuts of the type of VFD proposed for review and approval.

u. Photocells (Photoelectric Sensors)

1.) Provide photocells of the self-contained, retro-reflective type using an infrared modulated light source with sensitivity adjustment and LED status indicator that is readily visible. Retro-reflective type photocells are to be used for applications where the distance between the photocell and the reflector is less than 10'.

2.) Photocell applications that require a scan distance of 10' or greater are to use a separate transmitter and receiver rather than the single retro-reflective photocell.

3.) Use photocells of the quick disconnect type, which permits the removal and replacement of the photocell device without requiring the rewiring of the device.

4.) Due to wiring constraints and noise on low voltage lines generating false triggers, DC type photocells are not permitted.

5.) Mount photocells to structural members or side guards using an adjustable bracket as supplied by the photocell manufacturer so that the photocell is mounted in a vertical, not horizontal, attitude. Alignment and status LEDs shall be easily visible for maintenance personnel. All sensors and cabling shall be firmly anchored and protected from equipment and personnel impact and from random forces imposed by maintenance personnel servicing the equipment or staff working in the area. Mounting and protection devices shall inhibit tampering with sensors and their setting by non-maintenance personnel.

6.) Photocell mountings are to be directly attached to the conveyor structure as required. Use of shims between the conveyor structure and the photocell mountings is not acceptable. No penetrations through the side guards or attachment by means of magnets or other non-permanent attachment methods shall be permitted for photocell mountings or mounting brackets.

7.) Hex head 1/4" - 20 bolts of appropriate length and related 1/4" - 20 hardware (flat washers, lock washers and nuts) are to be used for the mounting of the photocells. Use of round head bolts is not acceptable.

8.) Mount reflectors to side guards using brackets providing both vertical and rotational adjustment. No penetrations through the side guards shall be permitted for reflector bracket mounting.

9.) Where holes through side guards are required, the holes shall be a maximum of 1.5" in diameter and located so that the center of the photocell beam is located either 2.5"

Copyright © 2018 by BNP Associates, Inc. (BNP)

or 3" (must be consistent, e.g. all 2.5" or all 3") above the conveyor belt. The holes in the side guards shall be dimpled away from baggage flow to minimize the possibility of snagging a bag and causing a jam. Oblong openings in the conveyor side guards are not acceptable.

10.) Only one side guard opening per photocell and one side guard opening per related photocell reflector would be accepted. Any unused photocell/reflector openings in the side guards shall be properly filled with a welded circular blank, ground smooth and properly painted.

11.) Locate photocells on the side of a conveyor having the lesser chance of contact by operating personnel. Guard photocells if susceptible to personnel contact. The photocells are to be located on the catwalk side of conveyors to ensure maintenance access.

12.) Do not attach the white phenolic plate photocell device ID plate to the photocell. Mount the ID plate on the side guard adjacent to the photocell.

13.) Provide photocells as required by the functional needs of the BHS. Photocells shall indicate a reliable life of over 10 million cycles and be repetitive and unaffected by environmental conditions such as vibration, rain, humidity, cold, heat, dust and sunlight. Provisions shall be made to effectively accomplish the sensing of any of the typical types of airline baggage and packages. Photocell installation shall minimize vibration and shall provide protection for both the sensor and its associated wiring. Specifically, care shall be exhibited in the mounting of the photocell and its control wiring to minimize the hazard of damage from the moving of baggage, contact with associated components or by personnel working on or in the vicinity of the system.

14.) Use a flexible cordset for connection of photocells to minimize vibration and shall provide protection for both the sensor and its associated wiring.

15.) Provide cordsets of an appropriate length to connect to photocells such that there is no greater than 12" of excess cable length remaining. The excess cable shall be coiled and secured to the associated conveyor with the use of cable mounting clips. Do not use plastic cable ties to secure the cordset.

16.) Photocells shall not be subject to interference from standard communication systems employed at the airport location due to airport and airline radio ground communications, ground to aircraft communications, aircraft to aircraft communications or any form of radar equipment operation.

C. Electrical Device Identification

1. The electrical control stations, their related control devices, field wired control devices shall be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the control station and control device. Dymo-type labels are not acceptable. Do not attach the white phenolic plate to any field device that can be easily replaced due to failure ((i.e. photocell or limit switch) as this would also require the removal and reattachment of the ID plate), attach the plate to the side guard or non-removable structure adjacent to the device.

2. The electrical control stations, their related control devices, field wired control devices and the electrical control devices mounted within the BHS related motor control panels (MCPs) shall use the following device identification format and designations. The format and identification that are used in this specification are to be used for reference purposes only. The actual format and identification for the project equipment/components shall appear on the designated equipment and the entire project related documentation. Submit the electrical device identification format and proposed designations to the Owner or their Representative for review and approval, prior to proceeding with the actual work.

a. Control Stations

1.) Control Stations shall be identified with the prefix CS followed by the actual Conveyor or BHS Equipment Identification Number to which the Control Station is related. For example, CS/TC1-14 identifies a Control Station located on Ticket Counter Subsystem #1 related Conveyor #14. Note that when there is more than one Control Station associated with a Conveyor or BHS Device, alpha designators shall

Copyright © 2018 by BNP Associates, Inc. (BNP)

also be used. For example, CS/TC1-14A, CS/TC1-14B, CS/TC1-14C signifies that Ticket Counter, Subsystem #1 related Conveyor #14 has three Control Stations. The "A" alpha designator identifies the Station related to the charge end of the Conveyor while the last or highest letter indicates the Station closest to the discharge end of the Conveyor.

2.) Each Control Station shall be identified with a permanently attached white phenolic plate, engraved with black characters, providing the identification of the Control Station. Dymo- type labels are not acceptable.

b. Control Station Devices

1.) Control Station Devices shall be identified as follows:

Control Station Device	Identification
Start/Re-Start Pushbutton	SPB
Normal Stop Pushbutton	PBS
Emergency Stop Pushbutton	EPB
Reset Pushbutton	RPB
Selector Switch	SSW
Key Operated Switch	KSW
Sonalert Warning Device	ALM
Lamp Test Pushbutton	TPB
Alarm Silence Pushbutton	APB
Door Close Pushbutton	CPB
Door Open Pushbutton	OPB
Jog Pushbutton	JPB
Jog Selector Switch	JSW
Colored Indicator Light (the first letter of the lamp color will appear instead of the underscore)	LT_

2.) For example: The designation CS/TC1-14/RPB identifies a Reset Pushbutton in the Control Station located at Ticket Counter Conveyor TC1-16.

3.) Note that the above Control Station Device designations are to appear on all electrical drawings, including wiring and schematics.

4.) Control Station Control Devices (pushbuttons, pilot lights, switches and audible alarms) identification descriptors shall be clearly identified by permanently attached white phenolic plates, engraved with black characters, except emergency stop devices which shall comply with NFPA 70 and show their operational relationships to their respective subsystem(s).

5.) All e-stop pushbuttons shall clearly indicate all conveyors affected by that e-stop (i.e.: TC1-01/TC1-04 indicates that the E-stop will stop conveyors TC1-01 through TC1-04). Dymo - type labels are not acceptable.

6.) All Jam reset pushbuttons shall indicate the conveyor segments, which are controlled by that jam reset control station.

7.) Control Station Control Device Function I.D. Tags shall be positioned for ease of reading. Align the tag's legend so that it is legible (oriented) from the operator's access side of the control station.

c. Field Wired Control Devices

1.) Photocells shall be identified as PE followed by the Identification of the Baggage

Copyright © 2018 by BNP Associates, Inc. (BNP)

Handling Device or Conveyor on which the Photocell is mounted. For example: PE/TC1-06 identifies a Photocell located on Ticket Counter Conveyor TC1-06.

2.) Limit Switches shall be identified as LS followed by the identification of the Baggage Handling Device or Conveyor to which the Limit Switch is related. For example: LS/TC1-03 identifies a Limit Switch on Ticket Counter Conveyor TC1-03.

3.) Warning Alarms shall be identified as WA followed by the Identification of the Baggage Handling Device or Conveyor to which the Warning Alarm is related. For example: WA/MU1 identifies a Warning Alarm associated with Make-up Device 1.

4.) Lights shall be identified as LT followed by the identification of the Baggage Handling Device or Conveyor on which the light is mounted. For example: LT/TC1-01 identifies a light located adjacent or mounted on Ticket Counter Conveyor TC1-01.

5.) Emergency Stop Lanyards shall be identified as EL followed by the identification of the Baggage System Conveyor on which the Emergency Stop Lanyard Limit Switch is mounted. For example: EL/TC1-13 identifies an Emergency Stop lanyard related to Runout Conveyor TC1-13.

6.) Run Lanyards shall be identified as RL followed by the identification of the Baggage System Conveyor on which the Run Lanyard Limit Switch is mounted. For example: RL/TC1-13 identifies a Run Lanyard mounted on Runout Conveyor TC1-13.

7.) Security Card Readers shall be identified as SR followed by the identification of the Baggage System Conveyor to which the Security Card Reader is related. For example: SR/TC1-01 identifies a security card reader related to Ticket Counter Conveyor TC1-01.

8.) Motor Safety Disconnect Switches shall be identified as “MSD” followed by the identification of the Baggage System Conveyor to which the Motor Safety Disconnect Switch is related. For example: MSD/TC1-09 identifies a Motor Safety Disconnect Switch related to Ticket Counter Conveyor TC1-09.

9.) End Safety Guards shall be identified as ESG followed by the identification of the Baggage System Conveyor to which the End Safety Guard is related. For example, ESG/TC1-14 identifies an End Safety Guard related to Runout Conveyor TC1-14.

10.) Field Wired Control Devices (Security Card Readers, Photocells, Limit Switches, and the like) are to be clearly identified by permanently attached white phenolic plates, engraved with black characters with the control device I.D. Dymo type labels are not acceptable.

11.) All field installed Junction Boxes are to be provided with white phenolic plates engraved with black characters. The I.D. tags are to be located, so as to be easily read from the adjacent maintenance access areas. The I.D. tags shall be consistent with the associated subsystem identifications noted on the wiring schematics. For example, the second junction box from MCP-TC1 would be "JB/TC1-02".

d. Control Devices within Motor Control Panels and Workstation

1.) The identification of control devices and components such as relays, timers, transformers, power supplies, overloads, fuses, and PLCs within motor control panels, workstation or computer cabinet must be identified with I.D. tags.

2.) The I.D. tags shall be constructed of a white phenolic plate engraved with black characters. Dymo type labels are not acceptable. The I.D. tags must be located so that they can be easily read when the related motor control panel, workstation or computer cabinet door is opened.

3.) The I.D. tags are not to be mounted on the covers of the plastic wireways within the related cabinet or control panel.

4.) The I.D. tags for motor starters must contain the conveyor I.D. For example: The motor starter I.D. tag for conveyor TC1-01 would be “TC1-01M”.

2.11 MOTOR CONTROL PANELS (MCP)

A. General

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. All control equipment for the installed conveyors shall be housed within motor control panel(s) for the associated subsystems, as noted on the Contract Documents. Ensure adequate capacity within the panel(s) for all necessary control devices. Ensure adequate capacity within motor control panel(s) for all necessary control devices. Provide all MCPs consistent with the following requirements.
2. Provide motor control panels that are UL listed and labeled employing NEMA 12 enclosures with fully gasketed doors for interior use.
3. The MCP shall include a fusible disconnect switch (with Class J or R fuses) or molded-case circuit breaker for the incoming power supply. Additionally, the fused disconnect switch for the MCP shall have the following features:

    a. Flange enclosure construction where the external handle, connecting bar/cable and disconnect switch are always connected regardless if the MCP door is open or closed.
    b. Provides a quick make / quick break design.
    c. Provides an indication at the circuit breaker or the fusible disconnect switch inside the MCP that the disconnect is in the ON or OFF position.
    d. Provides a color coded external handle which shall provide visual indication external to the MCP if the disconnect switch is in the ON or OFF position.
    e. Provides the ability for the external handle to be padlocked in the OFF position for to support Lock-out / Tag-out requirements
    f. Provides a mechanical interlock to prevent the disconnect switch from being moved to the ON position unless the mechanical interlock is operated.
    g. Provides a mechanical interlock with the motor control panel door to prevent the motor control panel door from being opened with the disconnect switch in the ON position. The disconnect switch mechanical interlock to the door must have a manual over ride provision to permit the opening the door by qualified personnel using appropriate tools with the disconnect switch in the ON position.

4. Provide a Plexiglas Safety Shield with standoffs (or similar suitable finger-safe protection provisions) over the fuses / circuit breaker for all exposed 480 VAC power supply wiring/components relating to all MCPs.
5. The exterior of the MCP shall be painted. The interior of the panel or cabinet including the mounting panel shall be painted white.
6. Ensure that all Motor Control equipment complies with NEMA Standard ICS-1, ICS-2, UL publication 845 and other applicable standards of NEMA, UL, IEEE, ANSI and National Electrical Safety Codes (or applicable local codes).
7. Provide thermostatically controlled cooling fans within the MCPs to monitor and prevent internal temperatures from exceeding component environmental limits that are sized based on an ambient temperature of 100° F (configurable). Provide replaceable or cleanable filters on the intake vents. Configure, through appropriate controls functionality, the cooling fans to run when the respective subsystem(s) is operational and the pre-set ambient temperature is exceeded. The MCP cabinet over-temperature (e.g., 120° F) shall be monitored by the MCP Touchscreen Terminal and PC-type Computer Terminal Workstation, which is described elsewhere in this specification. When the MCP temperature exceeds the pre-set limit (which shall be configurable) a distinct alarm message shall be displayed on the MCP Touchscreen Terminals and PC-type Computer Terminal Workstation graphics and text display. Provide separate circuits for the power and control of the MCP cooling fans; note that these circuits shall originate within the respective MCP. As an option, and at no additional cost to the project, the BHS Contractor may propose the use of an integral MCP air conditioning unit to prevent the internal temperature of the MCP from reaching 120°F; should this option be provided, install condensing unit drain tubes to the nearest drainage line, as coordinated with the Owner or their Representative.
8. Prior to the installation of overload heaters on the controllers, submit a motor schedule listing motor horsepower, voltage, phase, source of feed, circuit breaker size, disconnect size, conduit and wire size and overload heater size selected to be used.
9. Base interrupting rating of all circuit breakers, fused disconnect switches, motor control centers, and panel boards on short circuit calculations and ensure they are compatible and coordinate with base contract equipment. Refer to National Electrical Code Articles 110 and 430 (or local applicable code) to determine short circuit and overload requirements.

Copyright © 2018 by BNP Associates, Inc. (BNP)

10. Mount fuses or circuit breakers for each magnetic starter directly above the magnetic starter.
11. A laminated card showing motor schedule with horsepower, fuse size and heater size shall be affixed to the inside of the MCP door.
12. The working space in front of the MCP panel shall be a minimum of 36". In all cases, the workspace shall permit at least 90° opening of the MCP doors. Refer to National Electrical Code Article 110 (or local applicable code) to determine working space requirements and comply accordingly.
13. For any MCPs, that are not located on a raised curb / housekeeping pad provided by Structural (i.e. cabinets/panels located within the bagroom area but not in the locations shown on the Contract Drawings), provide a concrete or galvanized steel plinth, pedestal, legs or similar means to raise the MCP a minimum of 4 inches above the floor to minimize the possibility of any ground water damage to the MCPs.
14. Appropriately sized insulated bushings/seals shall be installed on all conduits and conduit fittings that enter/exit the Motor Control Panel(s).
15. BHS Contractor to supply and install transformers as necessary to power the MCPs.
16. Provide Panel View Touch Screen Monitor on the Front Face of the MCP Panel to Display Faults and Status of the Outbound System and Slope Plate Make-Up Device.

B. Installation Requirements

1. Comply with the following design and installation requirements:

    a. Wire the line side of fuses or circuit breakers to a line side terminal strip for their incoming supply.
    b. Wire the load side of the magnetic starter to a load side terminal strip for the outgoing load.
    c. Connect all control wires to terminal strips designated for control wiring.
    d. Make vertical runs of power and control wiring within the panel on either or both of the right or left sides of the backboard.
    e. Run horizontal runs of power and control wiring between the horizontal rows of starter/fuse block units.
    f. Enclose all vertical and horizontal wiring in plastic wireways.
    g. Make minimal wire runs to and from these wireways only to the nearest adjacent fuse block starter or terminal block.
    h. Use of "latching relays" is not acceptable.
    i. Use of "alternating relays" is not acceptable.
    j. Any "plug in" type device such as a relay, IEC starters or clutch/brake power supply shall be equipped with a spring clip type restraint to prevent the "plug in" device from becoming loose in its socket.
    k. Splicing of control or power wiring within the MCP is not acceptable. All internal and external "field" wiring shall be terminated on the appropriate MCP terminal strips.
    l. Appropriate sized insulated bushings shall be installed on all conduits or conduit fittings that enter the related MCP.
    m. All fuses shall be of the appropriate type and size of the FRN or FRS dual element type.

C. Panel Identification

1. Each Motor Control Panel must be identified with an I.D. Tag mounted on the outside face of the Panel Door to the immediate left of the MCP Main Disconnect. The Tag shall identify:

    a. MCP Designation
    b. Related Baggage Subsystem
    c. Related Conveyors or Devices Controlled by the MCP

2. The I.D. Tag shall be constructed of a white phenolic plate with a minimum thickness of 1/8" engraved with black characters. The I.D. Tag engraved characters shall be a minimum height of 1" or greater as required for readability.
3. The I.D. Tag shall be secured to the MCP door surface with a minimum of four rivets combined with an appropriate adhesive. Large tags shall require a minimum of four rivets, one for each corner of the tag.

Copyright © 2018 by BNP Associates, Inc. (BNP)

D. Shop Drawings

1. Submit shop drawings to show:

a. General Layouts of subsystem MCPs
b. Power, wiring and schematic diagrams
c. Outline and wiring diagrams of all special devices
d. Submit manufacturer's data for all components

E. Utility Outlet

1. In each enclosure or cabinet include a minimum of one appropriately fused grounded duplex receptacle utility outlet meeting locally applicable standards of 120 volt, 20-ampere capacity conveniently located within the panel.
2. The outlet is to be fed from the line side of the MCP, workstation, or computer cabinet power source (power supply via transformer supplied by BHS Contractor) so that the outlet power will remain on regardless of the condition of the MCP, workstation, or computer cabinet power.
3. The hot wire providing power to the outlet shall be yellow. All terminations of this wire shall be guarded in order to protect personnel from accidental contact. Mount a warning placard on the outside of the panel, next to the disconnect switch stating: "CAUTION - THIS CONTROL CABINET CONTAINS YELLOW WIRES WHICH WILL REMAIN "ENERGIZED" WHEN THE DISCONNECT SWITCH IS TURNED OFF."

F. Lighting

1. Equip each enclosure or cabinet with an appropriately fused fluorescent lamp extending at least three quarters of the width of the panel. Operate the lamp by a switch located inside the enclosure on the latch side of the primary door so that the light becomes illuminated whenever the enclosure or cabinet door has been opened.
2. The lamp(s) is to be fed from the line side of the MCP, workstation, or computer cabinet power source (power supply via transformer supplied by BHS Contractor) so that the fluorescent lamp will remain on regardless of the condition of the MCP, workstation, or computer cabinet power.
3. The hot wire providing power to the lamp shall be yellow. All terminations of this wire shall be guarded in order to protect personnel from accidental contact. Mount a warning placard on the outside of the panel, next to the disconnect switch stating: "CAUTION - THIS CONTROL CABINET CONTAINS YELLOW WIRES WHICH WILL REMAIN "ENERGIZED" WHEN THE DISCONNECT SWITCH IS TURNED OFF."

G. Control Devices

1. General

a. All MCPs are to be equipped with the following control devices regardless of the type of status monitoring being employed:

1.) System Ready Indication Lamp

a.) The MCP shall be equipped with a Green Indicator Lamp, which shall become illuminated to indicate that the system is ready for start-up and no faults are indicated on the BHS MCP Touchscreen Terminals and PC-type Computer Terminal Workstation.

2.) MCP Re-Start Pushbutton Switch

a.) A green momentary contact start pushbutton switch is to be provided for each system or subsystem that is controlled from the MCP.
b.) The MCP Re-Start Pushbutton Switch shall not be able to start the subsystem from a non-operational mode. It shall only be able to Re-Start the subsystem if the MCP fault has been cleared.

3.) MCP Emergency Stop Pushbutton Switch

a.) Each MCP shall be equipped with a red illuminated maintained contact

Copyright © 2018 by BNP Associates, Inc. (BNP)

mushroom head Pushbutton switch for the subsystem controlled from the MCP.

4.) System Fault Indication

a.) Amber Indicator Lamp shall be used to indicate a Fault condition (e.g., Jam). The Fault Indicator Lamp shall become illuminated whenever a Fault Detector within the subsystem has sensed a Fault Condition. The Indicator Lamp shall remain illuminated until the Fault Condition has been corrected.

5.) Motor Overload/VFD Fault Indication

a.) Blue Indicator Lamp shall be used to indicate Device or Conveyor Groups in which one or more Motor Overloads have tripped or VFD faults are active. The Blue Indicator Lamp shall become illuminated whenever a Motor Overload / VFD Fault Condition develops and shall remain illuminated until the tripped Overload or VFD Fault has been reset.

6.) Alarms

a.) Start-Up/Fault Warning Alarm(s): Each MCP shall be equipped with one amber flashing stack lamp and one audible horn to indicate imminent subsystem start-up or faults (such as but not limited to jams, motor overloads and the like). The design of the control circuitry shall be such so that multiple faults will always activate the audible and visual alarms; i.e., if a jam condition has activated the fault alarms and the alarm silence pushbutton has been depressed but the actual fault has not yet been corrected, a second fault occurring after the alarm has been silenced shall again activate the alarm.

b.) Emergency Stop Warning Alarm(s): Each MCP shall be equipped with one red flashing stack lamp and one audible horn to indicate an Emergency Stop situation in the subsystem.

7.) Alarm Silence Pushbutton Switch

a.) Each MCP shall be equipped with a black momentary contact "Alarm Silence" pushbutton switch. Activating the Alarm Silence Pushbutton shall silence the Audible Warning Alarm. However, the appropriate Indicator Lamp shall continue to be illuminated until the Fault Condition (such as but not limited to jam, motor overload, and e-stop.) has been corrected.

8.) Lamp Test Pushbutton Switch

a.) Each MCP shall be equipped with a yellow momentary contact "Lamp Test" Pushbutton switch. Activating this common lamp test push button shall test/illuminate all indicator lamps on the MCP door.

H. System Status

1. MCP Touchscreen Terminal

a. Supply, install and program Touchscreen Terminals such as an "Allen Bradley", family of "PanelView" terminals (or equivalent as approved by the Owner or their Representative).

b. The Touchscreen Terminal shall be installed for each MCP, at the locations indicated on the contract drawings. The Touchscreen Terminal shall be constructed as a NEMA 12 rating for indoor use.

c. The Touchscreen Terminal shall be capable of accurately and clearly depicting the subsystem(s) that are powered and controlled by the associated MCP. The terminal shall be configured to display subsystem status as described below, in both text and pictorial format. Submit to the Owner or their Representative the functional design for review and approval.

d. The graphics portion of the terminal shall display, in real time, dynamic pictorial format, the operational status of the subsystem conveyors and make-up device that are connected to the subsystem MCP PLCs. Framed icons and specific conveyor IDs representing conveyor sections shall change color according to the following scheme. This shall immediately

Copyright © 2018 by BNP Associates, Inc. (BNP)

highlight problem areas so that the problems that arise may be corrected in the minimum amount of time:

Condition	Color
Normal Operation – Conveyor Drive On/Running	Green
Normal Operation – Conveyor Drive Off/Timed Out	Black
Conveyor stopped due to "Cascading"	Magenta
Conveyor Full Condition	White
Emergency Stop Actuation	Red
Over-length/Over-height Condition	Flashing White
Motor Overload	Blue
VFD Fault	Flashing Blue
Conveyor Jam Condition	Yellow
PLC Communication Loss (Individual Components)	Red
Equipment Out of Service	Brown
Fire Alarm	Flashing Red
Over Temperature	Flashing Red

e. The textual portion of the terminal shall display, in color coded text format, the operational status of the conveyors and make-up device that are connected to the system PLCs. The terminal shall provide color indications of a predetermined fixed area of the respective subsystem(s). The text portion of the terminal shall not interfere with the graphical display area. The textual portion of the terminal shall automatically scroll to show the most current fault. The textual display shall also have a scroll back function to display faults that have scrolled off the display. The condition and the specific conveyor I.D representing the conveyor sections and system devices change color according to the following scheme. This shall immediately highlight problem areas so that the problems that arise may be corrected in the minimum amount of time:

Condition	Color	Text Displayed
Normal Operation – Conveyor Drive On	Green	Running
Normal Operation – Conveyor Drive Off	Black	Timed Out
Conveyor stopped due to "Cascading"	Magenta	Cascade Stopped
Conveyor Full Condition	White	Full
Emergency Stop Actuation	Red	E-Stopped
Over-length/Over-height Condition	Flashing White	Oversize
Motor Overload	Blue	Overload
VFD Fault	Flashing Blue	VFD Fault
Conveyor Jam Condition	Yellow	Jam
PLC Communication Loss	Red	Communication

Copyright © 2018 by BNP Associates, Inc. (BNP)

Condition	Color	Text Displayed
(Individual Components)		Error
Equipment Out of Service	Brown	Out of Service
Fire Alarm	Red	Fire Alarm
Over Temperature	Red	Over Temperature

f. The Touchscreen Terminal shall be connected to an audio/visual alarm, which will be activated when a system alarm is triggered (e.g., jam condition, E-stop).
g. Provide the Touchscreen Terminal with EPROM or similar to provide memory back-up.

2. Status Monitoring on the BHS PC Type Computer Terminal Workstation

a. Each of the conveyor subsystem's status shall be monitored by the BHS PC-type Computer Terminal Workstation Maintenance Diagnostics System, and the 43" monitor that will be located in the Airport Safety Office, as described within this specification.

2.12 BHS PC-TYPE COMPUTER TERMINAL WORKSTATION

A. General Design Requirements

1. Supply, install and program one (1) PC-type Computer Terminal Workstation with associated HMI monitors and fault diagnostics displays primarily for use by the Owner. The PC-type Computer Terminal Workstation shall consist of, as a minimum, a Windows operating system PC with two (2) 22" monitors and appropriate Graphics Card to support a minimum resolution of 1920x1080, 8x DVD + RW, 256 GB Solid State Drive, 8 GB RAM, an audible alarm with both an alarm silence and a means to Enable/disable this feature. Provide FactoryTalk View SE client software plus all software to support the functions associated with the use as a fault monitoring diagnostics and reporting computer terminal, the hardware of which shall also include the capacity to support the installation of necessary software applications for future reporting functions that shall be reviewed and coordinated with the Owner or their representative during the BHS Contractor's engineering phase.
2. The PC-type Computer Terminal Workstation shall be installed in the Airport Safety Office as a desktop unit with associated keyboard, mouse and monitors. The final location of the workstation shall be coordinated with the Owner.
3. The PC-type Computer Terminal Workstation shall be programmed to monitor the system status and have the capability to serve three (3) functions, as follows:

a. Data base processing.
b. Monitoring of system status.
c. Statistical information storage.

4. The workstation shall provide the following functionality:

a. Graphics and text displays, including the ability to zoom-in to selective areas of outbound BHS subsystem equipment.
b. Capability to change the controls functionality of the conveyor segment operation through the specified user level password access, for controls functions such as to inhibit the operation of conveyor equipment and the like; all of which shall be reviewed and coordinated with the Owner and their representatives.
c. Provide read access to the daily alarm logs. This access shall also allow the user to save the alarm log data to a CSV (Comma Separated Variable) file, onto a CD/DVD and Hard Drive in the remote workstation. The workstation shall also be provided with a copy of Microsoft Excel.

5. The PC-type Computer Terminal Workstation shall be password protected and require login to perform any functions other than view the display (i.e., anything to do with the alarm logs).
6. The BHS PC-type Computer Terminal Workstation shall be capable of accurately and clearly

Copyright © 2018 by BNP Associates, Inc. (BNP)

depicting the entire BHS. The terminal(s) shall be configured to display system status as described below, in both text and pictorial format. Submit to the Owner or their Representative the functional design for approval.

7. The graphics portion of the terminals shall display, in real time, dynamic pictorial format, the operational status of all conveyor segments and make up device that are connected to the Baggage Handling PLC system. Framed icons and specific conveyor I.Ds representing conveyor sections shall change color according to the following scheme. This shall immediately highlight problem areas so that the problems that arise may be corrected in the minimum amount of time:

Condition	Color
Normal Operation – Conveyor Drive On/Running	Green
Normal Operation – Conveyor Drive Off/Timed Out	Black
Conveyor stopped due to “Cascading”	Magenta
Conveyor Full Condition	White
Emergency Stop Actuation	Red
Over-Length/Over-Height Condition	Flashing White
Motor Overload	Blue
VFD Fault	Flashing Blue
Conveyor Jam Condition	Yellow
PLC Communication Loss (Individual Components)	Red
Equipment Out of Service	Brown
Over Temperature	Flashing Red
Fire Alarm	Flashing Red
Data Communication Error	Yellow
End Safety Cap Activated	Red

8. The textual portion of the terminals shall display, in color coded text format, the operational status of the conveyor segments and make up device that are connected to the Baggage Handling PLC system. The terminals shall provide color indications of a predetermined fixed area of the system. The text portion of the terminal shall not interfere with the graphical display area. The textual portion of the terminal shall automatically scroll to show the most current fault. The textual display shall also have a scroll back function to display faults that have scrolled off the display. The condition and the specific conveyor I.D representing the conveyor sections and system devices shall change color according to the following scheme. This shall immediately highlight problem areas so that the problems that arise may be corrected in the minimum amount of time:

Condition	Color	Text Displayed
Normal Operation – Conveyor Drive On/Running	Green	Running
Normal Operation – Conveyor Drive Off/Timed out	Black	Timed Out
Conveyor stopped due to “Cascading”	Magenta	Cascade Stopped
Conveyor Full Condition	White	Full
Emergency Stop Actuation	Red	E-Stopped
Overlength/Overheight Condition	Flashing White	Oversize
Motor Overload	Blue	Overload
VFD Fault	Flashing Blue	VFD Fault

Copyright © 2018 by BNP Associates, Inc. (BNP)

Condition	Color	Text Displayed
Conveyor Jam Condition	Yellow	Jam
Data Communication Error	Yellow	Communication Error
PLC Communication Loss (Individual Components)	Red	Communication Loss
Equipment Out of Service	Brown	Out of Service
Fire Alarm	Red	Fire Alarm
Over Temperature	Red	Over Temperature
End Safety Cap Activated	Red	End Safety Cap Activated

9. The BHS PC-type Computer Terminal Workstation shall be connected to an audio/visual alarm, which will be activated when a system alarm is triggered (i.e. jam condition or E-stop and the like).
10. Provide the PC-type Computer Terminal Workstation with EPROM or similar to provide memory backup.
11. BHS Wall Mounted Flat Screen Monitor
    a. The BHS PC-type Computer Terminal Workstation shall be provided with a wall mounted type “flat screen” video monitor. The size of the screen shall be 43” (minimum), measured diagonally and shall be adequate to ensure legibility of screen contents from all viewing locations within the Airport Safety Office. The monitors can be either burn-in resistant LED or OLED. The monitor shall display in real time, dynamic pictorial format, the operational status of the conveyors for the outbound BHS.
    b. It shall be possible to display a single graphic image in each screen. Provide and install all hardware, appropriate framing, necessary mounting provisions, software, cabling, and conduits necessary for the complete installation of these units, including, where applicable, suitable equipment enclosures. Additionally, the 43” monitor shall be provided with an articulating wall mount bracket/arm that shall permit the monitor to be pulled out and adjusted for viewing and/or maintenance access from backside.
    c. The actual screen layouts presented by the monitor will be selected by personnel from the workstation and shall be capable of displaying graphic or text images that are selectable and different than those displayed in the Workstation Monitors. It shall also be acceptable for the BHS Contractor to provide a separate controller specifically for the large screen display in lieu of having the workstation monitors providing control.
    d. The display quality shall permit easy identification of screen contents from all areas of the installed location from which viewing is possible, under all conditions of ambient lighting of the Airport Safety Office environment.
    e. All screen graphic layouts shall be able to be displayed on the monitor.
12. Printer
    a. All printed messages shall be date and time stamped. Fault Alarm messages are to provide date and time of occurrence and date and topic of fault clear. Reports are to provide date and time of printing. All times shall be given in military time, e.g., one o'clock in the afternoon shall be printed as 13:00:00.
    b. Provide a high-speed laser printer for the Workstation to print reports.
    c. Provide a local means of troubleshooting faults at the printer.
    d. A means to manually clear the printer queue (buffer) shall be provided.
    e. All dates printed out shall be in the order of Month/Day/Year.
    f. Submit to the Owner or their Representative the proposed printer manufacturer's literature for review and approval
13. Reporting

Copyright © 2018 by BNP Associates, Inc. (BNP)

a. Provide the statistical information gathering and report generation capability to display and print certain defined information considered essential to the successful operation of the system.
b. Provide five (5) levels of usernames with password protection against unauthorized access to the system:

Level	User	Access
Level 1	Handling Agent	Ability to view, print and achieve reports regarding passenger and flights handled by the agent logged on
Level 2	Operator	Access to normal operational modes
Level 3	System Engineer	Access to all operational modes
Level 4	System Manager	Access to all operational modes plus ability to change software
Level 5	System Administrator	Access to all operational modes plus ability to change software and assign user names and passwords

c. Provide a standard "Report Generator" to permit compilation of additional statistical reports or to modify existing reports. Requires Level 4 and 5 protections for use of this function.
d. Employ a user-friendly Human Machine Interface (HMI) with menu-driven routines to permit access to the system.
e. The type of fault diagnostics and reporting functions that shall be employed for this project shall have the functionality (to be user friendly) to allow the Owner to easily modify/generate/develop Operational and Maintenance reports to meet their own needs.
f. Provide ability to view all reports on screen as well as in printed format or file format (CSV and PDF).
g. Provide ability to save, in buffer storage, and print on a first-in, first-out basis up to 20-flight closeout Reports or end of day reports in the event the printer is busy at any given time.
h. Provide ability to produce daily, hourly, weekly, monthly, quarterly, and annual reports as well as reports based on a user defined interval.
i. Provide the capability to archive all records of statistical data on DVD (tape or CD-ROM is acceptable if required by the Owner).

B. Building Fire Alarm System

1. The subsystems shall interface directly with the building fire alarm system. Coordinate the specific origin of the building fire alarm system information and requirements with the Fire Alarm System Contractor.
2. Coordinate with the Fire Marshal and Fire Alarm System Contractor for the location of all fire zones and for the shutdown of conveyors that are impacted by a fire alarm.
3. Clearly display the conveyor segments affected by the alarmed fire zone(s) on the MCP Touchscreen Terminal and PC-type Computer Terminal Workstation displays.

C. Programmable Logic Controller (PLC) Functional Description

1. Provide Programmable Logic Controller(s) (PLCs) for direct interface between all input and output devices in the BHS. Wire emergency stop circuits through mechanical control relays; which, when interrupted, will remove all power from the output modules of the PLC.
2. Provide each PLC with an EPROM or similar safeguard to provide memory backup.
3. Provide PLCs with Ethernet capability for connection to external devices, such as the Touchscreen Terminal at the MCP and the PC-type Computer Terminal Workstation.
4. Provide each PLC with a minimum of 35% excess memory or capacity for 25% expansion and each I/O with space for adding 25% more modules.
5. Input/output (I/O) modules shall have a visual indication of the status of each I/O point. The status displayed shall be for both signals input into each I/O module and the output signal from each I/O

Copyright © 2018 by BNP Associates, Inc. (BNP)

module.

6. Provide a fully annotated printout as well as a software copy of the up-to-date PLC software and program.
7. All outbound and oversize system Programmable Logic Controllers (PLCs) shall be backed up with an arrangement that permits quick replacement of a failed controller processor with a pre-loaded replacement controller processor (cold back-up). Quick replacement shall mean quick cable disconnection and removal of mounting bolts. Failure of a processor shall be annunciated at the MCP Touchscreen Terminals and the PC-type Computer Terminal Workstation both visually and audibly.
8. The primary function of the Programmable Logic Controllers (PLCs) shall be the control of all conveyors including, but not limited to:

    a. Jam detection
    b. Normal Start/stop routines
    c. Auto-Stop/Auto-Start timing circuits and start-up routines
    d. Actuation of merges.
    e. Cascade stop control
    f. Inch-and-Store control, start/stop routines
    g. Control of associated feed conveyors
    h. Statistical reporting to the MCP Touchscreen Terminals and the BHS PC-type Computer Terminal Workstation
    i. Self-diagnostics

9. All PLCs, interface modules and I/O cards shall be located in MCP cabinets as specified herein.
10. Commonality of PLC manufacturers shall be maintained utilizing the minimum number of individual models.

D. Software Design Requirements

1. Incorporate software/hardware consistent with industry standards, and where required software/hardware that is compatible with the Owner's equipment. Schedule a series of coordination meetings with the Owner or their representatives (on-site) prior to detailed design to ensure the connectivity/compatibility proposed software/hardware system. Provide all connections between the BHS related computer/PLC systems.
2. Provide all software proprietary information to the Owner upon Final Acceptance, but this shall not release the BHS Contractor of responsibility for any technical defects (bugs) that occur with the software. In addition, submit to the Owner or their representative a staffing schedule (supervisors and software engineers) to accomplish the specified work.
3. For all software unique to the BHS and not "commercially available" the As-Built Deliverables shall include, as a minimum, all of the information necessary to make revisions in the software program applications for the BHS for changes or expansions or extension of the BHS, such as functional, performance and interface requirements; descriptions of the supervisory, control, and operating software; source listings; flow charts; configuration control documentation; and programmer and user manuals incorporating appropriate modification and control procedures, including the name of any sub-contractor used for preparation of this software.
4. For all "commercially available" software used in the BHS, the As-Built Deliverables shall include all of the documentation that is available from the supplier of such software. Copies of all programmer and user manuals and other similar material shall be provided to the Owner along with a complete and fully documented listing of all software programs.
5. All systems, including the BHS PC-type workstation shall be equipped with continuously running virus detection software to prevent virus infection. Submit details of the virus protection program (i.e. manufacturer and model/version) to the Owner or their representative for approval.
6. At a minimum, adhere to the following software architecture and provide all associated hardware required to accomplish intended functions of the BHS:

    a. Human Machine Interface (HMI)

        1.) Shall provide a user-friendly interface.
        2.) Shall be of the multi-tasking operating system type that can control multiple programs

Copyright © 2018 by BNP Associates, Inc. (BNP)

at once.

3.) Shall incorporate object linking and embedding (OLE) technology, or similar.

4.) Shall have the ability of running a software program that will automatically monitor the "wellness" of all installed software on the BHS workstation computers. Provide the capability of automatically initiating a self-test routine from any/all of the installed computers.

b. Networking/Communication

1.) Shall be compatible with the data communication highway(s) (DCH) protocols.

2.) Shall provide fast interfacing between all communication/ control tiers.

E. Software Confidentiality

1. Do not disclose, or use in future work, any proprietary operation information of the Owner's facility, or any information considered a trade secret by the Owner, which was obtained during the course of the project work.
2. Except as otherwise required by law, the Owner will not publicly disclose trade secrets or proprietary software information obtained from the BHS Contractor in the performance of the BHS Contractor's obligations pursuant to this Contract. To the extent it is necessary to provide the BHS Contractor's trade secrets or proprietary software information in order to operate or maintain the BHS, the Owner will, by contract, prohibit the Owner's operation and maintenance contractor from publicly or privately disclosing the BHS Contractor's trade secrets or proprietary software information.
3. Any information that the BHS Contractor believes is a trade secret or proprietary software information shall be specifically identified and marked as such. Blanket type identification shall not be permitted.
4. In the event the Owner receives a request for BHS Contractor's specifically identified trade secrets or proprietary software information, the Owner will notify the BHS Contractor, and the BHS Contractor will be required to fully defend, in all forums, the Owner's refusal to produce such information. Otherwise, the Owner will make such information available.
5. All software version upgrades and bug fixes for proprietary software shall be provided during the five (5) year warranty period.

F. Source Code

1. All software shall be delivered with well-commented source code in addition to the executable version. Software shall be delivered in both hard copy and machine-readable formats on a media acceptable to the Owner. The BHS Contractor may propose a non-disclosure agreement.
2. The Owner shall have permission to use the software as necessary to support operations at Wilmington International Airport once obtained from the BHS Contractor.
3. A backup copy of the configured system software shall be provided on media acceptable to the Owner. All original distribution software shall be delivered with an installable backup.

- END OF PART 2 -

Copyright © 2018 by BNP Associates, Inc. (BNP)

PART 3 - EXECUTION

3.1 PREPARATION

A. General

1. Verify conditions in the field prior to start of work. If unanticipated mechanical, electrical, or other elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit written report to the Owner in accurate detail. Pending receipt of directive from the Owner, rearrange work schedule as necessary to continue overall job progress without undue delay.
2. Cover and protect systems and equipment from damage and soiling during installation. Erect and maintain dust-proof partitions and closures to prevent spread of dust or fumes to occupied portions of the building.
3. Obtain and pay for all airport security badges, permits, inspection fees, and certificates relative to all parts of the BHS construction. Deliver all certificates and letters of approval to the Owner or their Representative upon completion of work.
4. Provide supports or bracing to prevent movement, settling, or collapse in which an area is to be removed and adjacent system is to remain. If safety of system appears to be endangered, cease operations and notify the Owner immediately. Take precautions to support endangered work until determination is made for continuing operations.
5. Locate, identify, stub off and disconnect electrical system services that are not indicated to remain. Provide bypass connections to maintain continuity of electrical service to remaining system. Obtain permission and provide advance notice to the Owner if shutdown of electrical service is necessary during changeover.

3.2 WORKMANSHIP

A. General

1. Ensure that all equipment is manufactured and installed in accordance with the best commercial practices consistent with the intended design and usage and is acceptable to the Owner. Ensure that all material and components are new and free from defects. Do not provide used equipment, whether refurbished or reconditioned, without the express approval of the Owner.
2. Perform installation of work as shown within the specified BHS right-of-ways, with due care, including support and bracing. Be responsible for damage, which may be caused by such work.
3. Perform work in accordance with applicable technical sections of the specifications. Where cutting and new work involve the exterior building envelope, consult the Owner to ascertain if any existing guarantees, warranties and/or bonds are in force and execute the work so as not to invalidate such agreements.
4. Execute the work in a careful and orderly manner, with the least possible disturbance to the public and to the occupants of the building(s).
5. Materials installed by the BHS Contractor, whether provided by the BHS Contractor or not, shall be installed in a neat and workmanlike manner. Particular attention shall be paid to manufacturer's instructions as to installation procedures.
6. BHS Contractor shall comply with all appropriate safety measures as prescribed by OSHA in all places of employment for all employees engaged in the construction work.
7. Take necessary precautions to keep noise producing operations (such as impact hammering, Carborundum sawing, compressed air machinery and the like) to a minimum. Select equipment, which is of a quieter nature than others and enclose areas of operation with acoustical screens and partitions or other means necessary to accomplish reduction of noise.
8. Equip motorized equipment with mufflers or other types of sound control and blanket equipment with acoustical materials.
9. Locate the installation of equipment safely so that no part thereof shall endanger normal airport operations, including runways, terminals, terminal buildings, approach ways, and power utility, lighting and communication lines.

Copyright © 2018 by BNP Associates, Inc. (BNP)

10. Promptly remove debris to avoid interference with system operations.
11. Replace any damage or work in place, including existing fireproofing that has been damaged as part of the Work.
12. Cut out embedded anchorage and attachment items as required to properly provide for patching and repair of the respective finishes.
13. Ensure that the standard of work and materials throughout the Project shall be of first-class quality and workmanship in every respect. The Owner shall not accept workmanship, which for any reason, is otherwise.
14. The Owner or their Representative shall reserve the right to inspect any conveyor component at the BHS Contractor's factory prior to shipment of said components. The BHS Contractor shall coordinate with the Owner or their Representative, fabrication of any components that the Owner or their Representative requests to inspect such that said components are fully assembled and available for inspection by the Owner or their Representative at the previously arranged time of the factory visit.

3.3 FABRICATION & INSTALLATION SPECIAL CONSIDERATIONS

A. General

1. Equipment is to be designed to meet the requirements of handling airline baggage. This entails consideration and care to be used particularly in fabrication of all components to ensure that projections, welds, sharp corners and transfer points that may cause possible damage to various types of bundles, handbags, suitcases, and trunks are eliminated. Ensure that bottom glides on cases, strings, tags, straps, bag handles, destination tags and the like are guarded against damage on side guards, transfer points, and all surfaces which baggage may contact on the conveyor system.
2. Coordinate all on-going site work and with concurrent airport/airline operations.
3. Take into effect any long lead procurement items and bring them to the Owner's attention for prompt processing.
4. Take the necessary actions required to complete any installations in the ceiling space.
5. Ensure that the design and installation of all conveyor equipment provides maximum access for operation and maintenance personnel.

3.4 DELIVERY, STORAGE, HANDLING AND ON-SITE RESPONSIBILITIES

A. Delivery, Storage, Handling

1. Assume responsibility for the receiving, unloading, storage, protection, security and distribution of all material delivered to the site associated with this Contract.
2. As necessary for the work, provide flagmen and erect proper barricades and other safeguards, post danger signs and other warnings as warranted by hazards and existing conditions.
3. Assume responsibility for receiving, storing, handling, setting and connecting all equipment required for the BHS installation.
4. Provide and maintain adequate protection against weather so as to preserve the work, materials, equipment, apparatus and fixtures free from injury, pilferage or damage.
5. Furnish to the Owner, on demand, Bills of Lading for all equipment being shipped to the work site. Identify on each Bill of Lading each component and assembly involved, the equipment items to which they belong, the date and time of pick-up and the expected date and time of delivery to site. The shipping of such material shall involve proper identification of items, proper packing and proper means for unloading them at the work site.

B. On-Site responsibilities

1. General

   a. Erect all temporary barriers and barricades to separate work areas from areas of public access, if applicable.
   b. Provide exhaust fans (e.g. HEPA filter) to limit fumes/odors from welding, metal cutting and painting if the work being carried out is in an occupied/operational area.

Copyright © 2018 by BNP Associates, Inc. (BNP)

c. Coordinate with any interfacing, on-going site work.
d. Provide adequate portable office facilities, communication, equipment and locker room for field force.
e. The BHS Contractor shall pay all costs of rental, installation, use and removal of accommodation and communication equipment.
f. Furnish shop drawings for any substitutions of equipment specified in this specification or shown on the drawings. During the progress of the job, revised drawings may be issued. Ensure all work is performed based on the latest drawings issued.
g. Clean and maintain work spaces, travel routes, and any other areas affected by the Work including but not limited to:

1.) Remove on a daily basis all erection rubbish and discarded materials.
2.) The burning of waste material is prohibited. Remove and dispose of scrap and waste material in accordance with applicable laws, codes, regulation ordinances and permits.
3.) Be responsible for all fines received for failure to maintain or perform cleaning, and all costs due to damages directly caused by the BHS Contractor's work.
4.) The BHS Contractor shall use their hoisting material for rubbish removal.

h. Be cognizant that the equipment and lay down areas for the work may/will require relocation as directed by the Construction Manager or the Owner.
i. Be responsible for any employee parking and any site transportation that may be required to/from the construction site.
j. Be responsible for any escort service required for the transportation of materials and employees on the ATO side of the facilities. The BHS Contractor is responsible for all employee badges as required by the Owner. The Owner will not provide escort services for employees on the ATO and AOA side of the facility.
k. Enforce the Owner's instructions, laws, and regulations regarding signs, advertisements, fires and the presence of liquor and firearms by any person at the job site.
l. Provide the services of a competent field superintendent during erection, wiring, testing and correction of any discrepancies occurring during the Final Acceptance period.
m. Smoking shall only be allowed in areas as designated by the Owner.

2. Mechanical Work

a. Provide and install all supports, anchors and any other special considerations or requirements not provided for in this Specification but necessary to facilitate the complete mechanical installation and safe operation of all equipment and components.
b. Provide electrical connections for heavy-duty machinery, such as welding machines, and battery chargers as required for the installation of the BHS.
c. As construction proceeds, perform any additional site surveys which may be necessary.
d. Document in writing any mechanical, electrical or piping conflicts that may impact conveyor installation and submit to the Owner or their Representative immediately following the site inspection and prior to the installation.

3. Electrical Work

a. Provide the necessary conduit, wiring and other electrical components to complete the electrical installation from and including the Motor Control Panels (MCPs), to the equipment and be responsible for all electrical interconnections within the equipment and system.
b. Provide all labor, materials, equipment and service necessary for and reasonably incidental to proper completion of all electrical work including electronic controls as required for the proper operation of the system as detailed in these specifications. Provide within the design standardization of components, function and maintenance procedures.
c. Drawings and specifications are to be considered as supplementing each other. Work specified but not shown, or shown but not specified, shall be performed or furnished as though mentioned in both specifications and drawings.
d. Provide and install as required, at no additional cost to the project, minor items, accessories or devices reasonably inferable, as necessary, to complete the electrical installation.
e. Refer all conflicts between the requirements of these specifications and drawings and all

Copyright © 2018 by BNP Associates, Inc. (BNP)

applicable codes to the Owner or their Representative for clarification before proceeding with the affected portion of the installation.

f. Obtain and pay for all permits, inspection fees, and certificates relative to the electrical work. Deliver all certificates and letters of approval to the Owner upon completion of the work.

g. Locate all electrical equipment as shown on the drawings. However, actual field conditions shall be checked to determine exact locations and avoid interference with other trades. The Owner or their Representative must approve all deviations from the Contract Drawings.

h. At no additional cost, do any reasonable location adjustment of electrical equipment requested by the Owner prior to installation.

i. At no expense to the Owner, correct work improperly installed due to lack of construction verification.

j. Install materials and components in a neat and proficient manner. Particular attention shall be paid to manufacturer's instructions as to installation procedures.

3.5 INSTALLATION

A. General

1. Installation of the BHS shall be in strict compliance with the Construction Drawings, to be prepared in compliance with this Specification document and Contract Drawing Package. These drawings shall show in detail the location of each conveyor and the relationships between adjoining conveyors, conveyors and slides and any other transfer, which might affect baggage movement.
2. Assume responsibility for all interfaces between the BHS and the Facility. Check the "As-Built" condition of the Facility as defined in drawings and as confirmed by site inspection prior to fabrication or installation of any BHS equipment. The system arrangement and layout shall ensure equipment alignment and clearance when installed in the Facility.
3. Provide all equipment required to complete the total system. Furnish all tools and necessary equipment for the performance of the installation tasks and exhibit sufficient planning to ensure their availability at the job site as required by the workflow. The Owner shall not furnish tools, forklifts or erection equipment.
4. Staff the project to ensure timely completion. The BHS Contractor shall accelerate construction as required if schedule milestones are not met.
5. Provide all supports, anchors and any other items necessary to facilitate the complete mechanical installation and safe operation of all equipment and components.
6. Where equipment is to be installed in an operating facility provide a construction schedule to the Owner or their Representative for approval that will minimize interference with normal operations.
7. Take into consideration the location of building expansion joint locations which can affect the layout / installation of the conveyor or of structural attachment points.

B. Tolerances

1. Maintain the following tolerances for BHS equipment installation:

   a. Maintain dimensions to exterior building walls or building columns within 1/4".

   b. Install all conveyors level from side to side, within 1/8" across the width of the conveyor. In the event that the floor/ceiling is sloped, install the conveyors parallel to the floor in the direction of belt travel.

   c. In plan and in elevation, install conveyors straight to within 1/4" of a taut line stretched at the belt elevation over the length of each intermediate section of conveyor.

   d. Plumb supports vertical within 1/8" per 3 feet.

   e. Clearances to building elements shall be 12” (minimum) along a wall and 6” (minimum) along columns, hand/guard rails or other architectural elements such as bollards or the like, unless otherwise specified Maintain side clearances to building elements including walls and columns a minimum of 6" unless otherwise specified.

   f. Verify all “As-Built” and existing building conditions prior to final fabrication.

   g. Shimming between adjacent intermediate sections of conveyors is permissible but do not exceed 1/4" of total shim stock at any one location.

   h. The maximum allowable lateral offset in the conveyor slider bed shall be 1/8" in 40 feet of

Copyright © 2018 by BNP Associates, Inc. (BNP)

length.

i. As the building area becomes available, install all header steel (even if header steel is ahead of conveyor fabrication/delivery), to preserve conveyor right-of-ways. Preserve conveyor right-of-ways in all cases as soon as practicable.

C. Side Guards

1. Install side guards so that adjoining guards do not project into the flow of baggage. Clean any field cut edges and welds of burrs, and slag and grind smooth. Filler material at joints or seams is not permissible.
2. Notch the formed edge of the side guards around any vertical hanger or leg.
3. All side guard joints are to provide a snag-free surface. Side guards shall provide a continuous, uninterrupted surface the entire length and height of the joints. Lapped or out-of-line joints will not be accepted. Welding of joints is not permitted.
4. Care is to be used in the design and installation of the side guards at the point of intersection with the conveyor fire/security doors. This interface point must not act as a snag/catch point for baggage or baggage tags.
5. Conveyor side guards must be flared on the downstream side of the intersection with the conveyor fire/security doors. Additionally, special detail must be provided with the conveyor bed section at this point. Its width must be extended to close the void between the bedside rails and the flared side guards.
6. Adjacent side guard joints are to be of the bolted butt coupled joint type at power turns and conveyor sections. Coupling of adjacent side guards or head/tail pulley supports to power turns shall be in alignment with the effective belt width of the turn to prevent interference with baggage movement.
7. Side guards of power turns must not be welded to adjacent straight conveyor side guards.
8. Mounting of any mechanical or electrical equipment on the outside radius side guard of power turns is not acceptable since it restricts maintenance access to the outer perimeter chain or guide bearings of the power turn belt.

D. Belt Splicing/Lacing

1. Belting material and the related lacing hardware must be trimmed in a 1" “V” notch fashion. Additionally, the nylon jacket of the lacing connecting pin (cable) must be enlarged with heat to prevent any lateral movement of the connecting pin (cable).
2. If “dutchmans" are used, the length of the "dutchman" must be at least equal to or greater than the circumference of the conveyor drive pulley.
3. All belt splices, shall be cut square, to ensure proper tracking.
4. Install each lacing with a single lacing pin (cable) extending the full width of the belt.
5. Assemble the lacing so that the centerlines of the matching belts are in line within 1/8".
6. The actual length of belting installed on each unit is to be included on system drawings and in the spare parts list.
7. All rough top belting to be ground smooth within 1" of the cut end to allow proper seating of the belt lacing.
8. In locations that require a noise level of 65 dB (A) or less, such as the TSA's Screening Area, use vulcanized spliced belting. The conveyor shall facilitate the replacement of a clipper lacing for repair/replacement of damaged conveyor belt.

E. Belting

1. Check all pulleys and rollers for squareness to the centerline of the conveyor. Adjust when necessary.
2. Free conveyor beds of all foreign material and broom clean before pulling the belt.
3. Minimize number of belt lacings on each conveyor. Do not make belt segments shorter than 4'. Maximum acceptable number of lacings per conveyor belt segment is two (2).
4. Both sides of the pulley shaft elevations at the bearings shall be set within 1/32" of one another.

F. Belt Tracking

1. Ensure all belts track within 1 inch of center on any drive, tail pulley or intermediate point.

Copyright © 2018 by BNP Associates, Inc. (BNP)

2. Run each conveyor for a minimum of 4 hours with no load and 4 hours with a baggage load as encountered in actual service before acceptance testing.

G. Floor Supports

1. All conveyors shall be adequately sway braced in order to ensure that there is no lateral or longitudinal displacement.
2. All support structure must be designed and installed so that maintenance access to the conveyor components, gap pans and access to catwalk(s), work areas and drive aisles are not blocked.

H. Overhead Supports

1. The BHS Contractor is responsible for the design and structural integrity of all bolts, hangers, and support structures and provide all necessary materials required for installation.
2. All conveyors shall be adequately sway braced in order to ensure that there is no lateral or longitudinal displacement.
3. Locate conveyor supports at intermediate sections splices at 10 feet maximum to provide a rigid and rugged installation. Hanger rods shall be a minimum diameter of ¾ inch.
4. Installation and layout of header steel and all support structure shall not pose interference to maintenance and operation access.
5. The BHS Contractor shall repair/replace any new and/or existing fireproofing materials removed to allow the installation of BHS equipment header steel and supports structures or BHS electrical conduits / wireways.
6. Vibration isolators shall be used to ensure that there is no noticeable vibration transmitted to the building. For installation of vibration isolators, adhere to the following criteria:
    a. Where compression-type vibration isolators are installed below the sill, the threaded rod shall have a lock washer, a single flat washer, and a single nut above the sill while utilizing a single flat washer with a single nut and a single jam nut, installed in a jam configuration, below the vibration isolator. In this instance, the diameter of the flat washer must be equal to or greater than that of the contacting surface of the isolator.
    b. Where compression-type vibration isolators are installed above the overhead support structure, the threaded rod shall have a single flat washer (the diameter of which being equal to or greater than that of the contacting surface of the isolator) and one eccentric locking nut above the vibration isolator. Below the support structure the threaded rod shall have a lock washer, a single flat washer, and a single nut.
    c. Where spring-type vibration isolators are used, the threaded rod shall have an eccentric locking nut, a single flat washer, and a resilient washer in contact with the spring mechanism.
7. Provide means of height adjustment on all hanger rods. Once the proper heights are established, lock the adjustments by means of lock nuts.
8. Provide sufficient length of hanger rods to allow for height adjustment. Do not deform threads on threaded rod, which would prevent the ability for height adjustment.

I. Anchoring

1. Firmly anchor all equipment and structures to the floor or building structure where permitted, subject to review and approval by the Owner or their Representative. Align, level and finish grout, as required.
2. Anchor floor supports to the floor with a minimum of two (2) stud expansion anchors having a minimum size of 1/2" diameter by 2-3/4" long, unless otherwise noted on the specification drawings.
3. Weld floor supports which rest on a steel intermediate structure.
4. Anchor impact protection with a minimum of four 3/4" diameter epoxy adhesive anchors, each having a minimum tensile strength of 3,000 psi, concrete of 20,000 pounds and a minimum shear strength of 18,000 pounds, and a minimum embedment of 6”, unless otherwise noted on the specification drawings.

J. Lubrication

1. Fill all reducers to the proper oil level using oil recommended by the manufacturer.

Copyright © 2018 by BNP Associates, Inc. (BNP)

2. Install breathers at the highest opening.
3. Clean roller chains of dirt or debris and manually lubricate per manufacturer's recommendations.
4. Replace all lubrication fluids if testing or checkout period exceeds manufacturer's suggested start-up change-out interval.
5. Apply grease per manufacturer's specifications to all grease fittings (unless they are sealed for life type bearings) prior to initial start-up of the equipment.

K. Motor Installation

1. Wire each motor on all components to a separate disconnect switch which shall be mounted within sight of the motor but not more than 3 feet from the motor.
2. Provide a means of disconnecting power, including the capability of being locked in the "Off" position that meet or exceed the requirements of NEC Article 430 (or applicable local code), to any clutch or brake (if separately or group powered) mounted as part of drive unit so as to minimize the potential of electrical shock during any servicing or maintenance operations.

L. Jacking Bolt Installation

1. Install all jacking bolts in conjunction with pulley and motor bearing housings based on the following criteria:
   a. When mounted in a threaded bracket, engage the bearing with the cup of the jacking bolt and lock the jacking bolt in position with a jam nut on the inside of the bracket (i.e., between the bearing housing and the bracket) to ensure the proper locking configuration.
   b. When mounted in a non-threaded bracket, engage the bearing with the cup of the jacking bolt, position a jam nut on the inside of the bracket, and position a single flat washer, lock washer, and finished or semi-finished nut on the outside of the bracket (i.e., between the jacking bolt head and the bracket) to achieve the proper locking configuration.
2. Use of socket male/female adapters in conjunction with the jacking bolt is unacceptable.
3. Allow for minimum adjustability of the jacking bolt on either side of the mounting bracket equal to the maximum amount of adjustability provided for the associated bearing by the mounting slots.

M. Sheave/Sprocket Alignment

1. Align shafts, sprockets and sheaves using a steel straight edge. The use of a string for this purpose is not acceptable. Demonstrate during Acceptance Test that corresponding surfaces of mating sprockets/sheaves are in line within 1/32" in 24". Misalignment shall be determined by placing the straight edge against the face of one sprocket/sheave and measuring the gap it makes with the opposite sprocket/sheave. The operation shall then be reversed so that a total misalignment can be determined.

N. Fasteners

1. Protect all fasteners (such as but not limited to nuts, bolts, screws, and setscrews) against accidental loosening by the use of lock nuts, lock washers, jam nuts, or other suitable means, and against corrosion by plating or the use of corrosion resistant materials such as zinc plating or stainless steel materials.

O. Shaft Mounted Components

1. Mount all shaft mounted components using keys, splines, or equivalent, with positive retention devices.

P. Painting and Finishing

1. Equipment Finish
   a. Stainless Steel
      1.) Cover all metal components and surfaces of conveyors in public view with Type 304 stainless steel with No. 4 brush finish. Stainless steel shall incorporate smooth flush

Copyright © 2018 by BNP Associates, Inc. (BNP)

edge seams. Radius type edges are not acceptable.

2.) The BHS Contractor shall also be responsible for the design, fabrication and installation of stainless steel trim frames around conveyor wall penetrations in public areas. The trim frames shall be constructed of 12 gauge, 4" x 4" stainless steel angle. The BHS Contractor shall coordinate trim design/details with the Architect, the Owner or their Representative.

3.) All stainless steel trim elements and related connections are to be smooth and flush without openings or projections on which bag tags or straps may catch.

4.) All flat head screws used to attach the stainless steel shrouding, such as the horizontal portions attached to the conveyor bed, are to be completely countersunk so that no portion of the screw head is above the adjacent surfaces. Such flat head screws are to be of the Phillips Head type. Grinding or filing of the screw heads to accomplish the above is not acceptable.

5.) Field welding of any stainless steel trim element is not acceptable. Additionally, no blemishes of the stainless steel trim elements shall be accepted. This includes those blemishes that are caused by poor manufacturing practices as well as those caused in the field plus those caused by field attempts to remove any blemish.

b. Protect all metal surfaces from corrosion using one or more of the following methods:

1.) Use stainless steel for slides unless otherwise specified on the contract drawings.

2.) Use cold rolled or hot rolled low carbon steel primed and painted on both surfaces in all interior areas.

3.) As an alternative to items .2) above, the BHS Contractor can offer Powder Coating as an alternative due to superior quality and resistance to the elements.

4.) Use as received pre-painted housings from component supplier, such as motors, gearboxes and bearing housings.

5.) Paint conveyor slider bed components only on the outside exposed surfaces. Do not paint the surface in contact with the belting.

6.) Finish paint electrical enclosures normally purchased primed prior to assembly and delivery to the construction site.

7.) Protect all unpainted surfaces (shafts, slider bed, side guards) with a suitable rust inhibitor during shipping and installation.

8.) Prime and finish paint all catwalks, stairways, ladders, and support steel.

9.) Provide galvanized threaded rods. Protect the ends of all threaded rods with a suitable galvanizing spray after the threaded rods are cut to length.

10.) Apply an industrial quality primer and enamel to all to-be-painted surfaces in accordance with the manufacturer's directions. All paint shall be of the same make, type and color.

c. Prepare surface to be painted in accordance with paint manufacturer's requirements and as described below. If there is a discrepancy between the two, the manufacturer's requirements shall take precedence. Suitable precaution shall be taken to ensure cleanliness during the period between cleaning and other finishing processes.

1.) Preparation of Surface

a.) Prior to the application of any finish, clean all surfaces to be free of dirt, grease, oil, flux, flash metal, spatter metal, sand, rust, scale, or oxides, and all other debris that might interfere with the effective application of the finish. Clean surfaces immediately before the finishing operation. Take suitable precaution to ensure cleanliness during the period (which shall be of minimum duration) between cleaning and other finishing processes. For galvanized surfaces, adhere to the following:

(1.) Clean: Prepare surfaces so prime coat bonds well and adheres permanently.

(2.) Rust-Inhibitive Wash: Use a compatible chemical solution such as phosphoric metal etches. Thoroughly remove solution with water and allow drying.

Copyright © 2018 by BNP Associates, Inc. (BNP)

2.) General Application: Apply primer and enamel to provide a surface of high quality appearance free from runs, sags, cracks, flaking, peeling, blushing, or other defects which may affect drying characteristics, durability, and appearance of the painted surfaces. Apply primer and enamel by brushing, spraying, or dipping.

3.) Basic Application: Finish surfaces with not less than one coat of primer and one coat of enamel. Apply the primer and one coat of enamel at the factory and the touch up of enamel, if required, shall be applied at the installation site, after erection, by brushing. When primer or enamel applied to the equipment prior to erection has been burned, chipped, or otherwise removed during erection, or where new unfinished metal is installed, finish the exposed surfaces with not less than one coat of primer and a finish coat of enamel of the same color and type as originally painted, after sanding the surface to be painted down to the bare metal. After installation, clean and touch up all scuffed or otherwise marred surfaces, as above.

4.) Masking: Do not obscure equipment nameplates, identification plates, or other identifying markings when painting the equipment. Whenever possible, apply the plates and markings after painting. In all cases where they cannot be applied after painting, mask or otherwise protect them to retain their legibility. After painting, thoroughly and effectively remove all masking and protective coatings.

2. Conveyor Identification

a. Permanently and indelibly mark all conveyor equipment such as but not limited to conveyors (both powered and slave driven), merge conveyors, , make up units, and power turn conveyors with its respective (discrete) identification as defined on the contract drawings. All conveyor segments shall be identified as specified elsewhere in this document by carefully and neatly painting with black paint the equipment identification characters utilizing a stencil, nominally 4" in height, in a conspicuous location (on both sides of a conveyor adjacent to the conveyor drive in the case of a conveyor). The only acceptable identification markings on any conveyor equipment, is to be of the specified conveyor identification numbers for this project. Any other form of identification or markings on the conveyor equipment is not acceptable and must be removed.

b. Identify conveyors in public areas by means of engraved plaques (riveted or bolted) with 2" high black lettering on a stainless steel background.

c. Conveyor identification shall be consecutive with no missing numbers in a sequence. In the event of any additions or deletions prior to each system installation, renumber the conveyors to adhere to this requirement.

d. Completely remove or print over any identification on reused equipment or any temporary markings associated on conveyors for manufacture, shipping or installation.

e. Where temporary markings or labels on the conveyors or other equipment are required for installation, use a medium which is readily removable with water or a readily available commercial solvent, such that they may be removed without requiring any refinishing of the surface on which they appear. After installing, remove any temporary markings.

Q. Pavement Markings/Striping

1. Provide painted caution area on bagroom floor at all locations that are exposed to vehicular traffic, airline and TSA bagroom operational areas. Similar striping zones shall also be painted for reserved locations pertaining to swing down ladder drop zones as well as right-of-way clearance paths for EDS removal, staging area for live animal screening (Pre and Post Screened areas), and path to/from Oversize Checked Baggage Screening, as illustrated in the accompanying drawings.
2. Paint color for pavement markings shall be Federal Standard Number 595-13538 for yellow paint.

R. Safety Signage

1. Furnish and install safety signage throughout the BHS as described within these Contract Documents and any associated addendums. The safety signage shall be located in all areas and locations where there is exposure to hazards for maintenance/operational personnel and the public. Refer to OSHA, CEMA**,** ANSI, NEC, National Safety Council, local, federal and state codes for recommended location, size, shape, design and verbiage required for safety signage, examples of

Copyright © 2018 by BNP Associates, Inc. (BNP)

some of the types of signs are included in the contract drawings, these examples are not to be construed as the only signs required. The verbiage of the sign shall be appropriate for the particular location/hazard.

2. The safety signs shall be clearly visible and firmly affixed. The following is a list of locations where safety signage should be placed as a minimum, this list is not to be construed as being complete since it is only provided as a guide:

    a. All potential pinch points
    b. Rotating parts
    c. Chain and V belt guards
    d. On all conveyors that are under the control of auto start
    e. Outside of electrical cabinets and disconnects boxes
    f. On all catwalks including step up/step down locations
    g. At load and unload (baggage screening and make-up) areas
    h. Areas of low overhead clearance
    i. Fire/Security doors

3. Safety chains and prominently displayed placards/signs shall be placed at the bottom of ladders and/or other system access points to indicate restricted area for “authorized and trained personnel only”.
4. Placards/signs indicating locations of all E-stop control stations and lanyards shall be clearly visible.

S. Welding

1. Nationally certified welders shall perform all welding, and all welding shall be in strict compliance with local and national codes. Provide to the Owner or their Representative upon request, copies of certificates verifying that the welder(s) are nationally certified.
2. Only compressed natural gas (CNG) and electric welders shall be used.
3. Connecting welding equipment to any MCP power supply shall not be acceptable.
4. Provide a fire watch at all times during welding and in compliance with local codes. Before approving any cutting or welding operation, a fire safety supervisor or appointee shall inspect the work area and confirm that the following indicated precautions have been taken in order to prevent fires:

    a. Ten pound ABC Dry Chemical Fire Extinguisher to be kept on site.
    b. No flammable liquids permitted within 50 feet of work.
    c. Floors swept clean of combustibles.
    d. All wall and floor openings covered.
    e. Covers suspended beneath work to collect sparks.
    f. Opaque screens placed between work and spectators.
    g. Fire watch is required to observe all work and shall remain on site for a minimum of 30 minutes after completion of work.
    h. The Owner is to be notified prior to beginning work.

T. Maintenance Access

1. Where walls or other building elements immediately adjacent to conveyor equipment affect maintenance access, advise the Owner or their Representative of the location and size of the wall opening or clearance that needs to be developed to permit access to drive components, bearings, and other equipment that would normally be inaccessible because of the wall or other building elements.

3.6 SPECIAL CONTROL REQUIREMENTS

A. Control Stations

1. Mount controls, consisting of but not limited to push buttons, selector switches, indicator lights, in Control Stations. All controls shall be grouped to minimize the number of operating points throughout the system. In the application of a single control for a specific function, pushbutton stations may be employed.

Copyright © 2018 by BNP Associates, Inc. (BNP)

2. Locate control stations as specified. Position control stations so as not to impede access to the equipment for servicing.
3. Mount all Control Stations located in public areas flush to the equipment and equip with stainless steel cover plates. Control stations located in the view of the public shall not be mounted on the top surface of the conveyor front cladding.
4. Locate Control Stations so as to be clear of normal vehicular and personnel traffic lanes. Install guards to prevent inadvertent actuation where this cannot be accomplished.
5. Control Stations shall contain the appropriate control elements such as push buttons, selector switches, and those indicator lights, which will augment operations.
6. Control Station functions shall be identified in English using elementary concise terms supplemented by graphic symbols. All identification plates shall be mechanically affixed to the console face.
7. Control Stations shall conform to the environmental requirements specified herein. Outdoor applications shall employ weather tight, corrosion resistant boxes, switches, push buttons, and lights.
8. Emergency Stop push buttons, disrupting electrical control power, shall be employed where an emergency may require immediate shut down. Where more than one emergency stop pushbutton is used in any circuit or subsystem, only the indicator lamp in the activated E-Stop pushbutton shall be energized. Actuation of any emergency stop shall be announced on the respective status monitoring system.
9. Indicator lights, especially outside the facility, shall not be affected by extraneous light, and shall be clearly visible in all lighting conditions.
10. Control elements such as but not limited to switches, push buttons, and handles, shall be selected for ease of operation in an industrial "bag room" environment.
11. Control elements such as but not limited to switches, push buttons, indicator lights, and bulbs, shall be easily replaceable and reasonably protected from physical damage.
12. Freestanding control stations shall be mounted on extremely rugged and braced pedestals with large firmly anchored base plates. The design shall account for extraneous loading and generally abusive conditions.
13. Provide independently anchored impact protection wherever control panels, control consoles or control stations are exposed to work area traffic.
14. Provide yellow background behind all emergency stop actuators, per NFPA 79. It is permitted for the yellow background to be a yellow enclosure or via the use of a label/legend that is yellow.

B. Photocell Functions

1. As a minimum, provide photocells to perform the following functions:

    a. Cascade Stop
    b. Jam Detection
    c. Over-Height Detection
    d. Over-Length Detection
    e. Merge And Priority Control
    f. Auto Start
    g. Auto Stop
    h. Indexing Control (Accumulation)

2. Combine photocell functions wherever possible provided proper operation of each circuit is maintained.
3. Cascade Stop

    a. Locate a head end sensor photocell within 12" of the discharge ends of all straight conveyors and 6"on power turns and queue conveyors (or an appropriate distance from the discharge end to ensure that the piece of stopped baggage does not transition/stop on the downstream conveyor) so that the center of the photocell beam is approximately 2.5" or 3” above top of the conveyor belt to provide the signal for operation of cascade stop circuits.
    b. Should a downstream conveyor stop as a result of a jam condition or mechanical/electrical failure, the conveyor immediately upstream of the stopped conveyor shall continue to run until the head end photocell is blocked. At that moment, the conveyor shall stop. The

Copyright © 2018 by BNP Associates, Inc. (BNP)

preceding upstream conveyor will run until its head end photocell is blocked. This cascade stop function will continue through the upstream conveyors until the jam/failure is cleared or the first conveyor in the subsystem has stopped.

c. The cascade stop photocell shall also be utilized for jam detection functions, but no control station shall be installed in conjunction with this photocell. Upon the detection of a jam at this photocell, initiate the following steps:

1.) Stop the conveyor with the cascade stop photocell and the one immediately downstream.
2.) Provide a jam indication signal at the respective MCP Touchscreen Terminal, and the PC-type Computer Terminal Workstation, and a visual warning signal in the field (within the vicinity of the jam location).
3.) Illuminate the jam indicator light in the nearest jam reset/restart control station.

d. Cascade controls logic shall include programming to initiate the Ticket Counter Start Ready Pushbutton "Green light" to flash when the respective ticket counter conveyor subsystem has cascaded back to the load belt. This will notify the ticket counter agent that a jam/fault has occurred in the subsystem.

4. Jam Detection

a. Locate a head end sensor photocell to provide the signal for operation of jam detection circuits within approximately 12" of the discharge ends of all straight conveyors and 6"on power turns and queue conveyors (or an appropriate distance from the discharge end to ensure that the piece of stopped baggage does not transition/stop on the downstream conveyor). The center of the photocell beam is to be approximately 2.5" or 3" above top of the conveyor belt.
b. As a minimum, provide jam detection photocells and a jam indicator with a jam/restart/emergency stop control station in areas that have a relatively high frequency of jams. This shall include the discharge ends of all conveyors feeding onto power turns, at the bottom of inclines and decline conveyors, at all merges for both the primary and secondary conveying subsystems, and at any other location where experience indicates a potential jam point.
c. As soon as the photocell detects a jam (blocked for longer than an adjustable (0 to 10 seconds in the PLC), predetermined (nominally set to 6 seconds) length of time), initiate the following steps:

1.) Stop the conveyor with the jam detection photocell and the one immediately downstream, unless the photocell is mounted on a conveyor that feeds onto a power turn. In this case the conveyor with the jam detection photocell, the power turn and the conveyor immediately downstream of the power turn are to be stopped.
2.) Provide jam indication signal at the respective MCP Touchscreen Terminals and PC-type Computer Terminal Workstation.
3.) Illuminate the jam indicator light in the control station.

d. Whenever a conveyor stops for any reason, reset the jam detection timer and hold until the conveyor restarts.
e. The jam detection circuitry is only to function whenever the associated conveyor is running; i.e., if the conveyor is stopped and the jam detector photocell is blocked, the jam detection circuitry will not sense a jam condition and thus report a false jam condition.
f. Conveyors that cascade stop as a result of a jam are to be "latched stopped" through PLC logic until the jam reset push button has been activated.

5. Over-Height Detection

a. Provide over-height detection photocells at Ticket Counter input belts to the subsystem (TC1 and TC2) as well as to the Outbound Transport Line (OT1), to detect bags that are too high to clear the lowest downstream obstruction for all possible routes. This photocell shall be set at 34" above the top of the conveyor belt for standard conveyors, unless otherwise stated.
b. As soon as the photocell is interrupted, stop the conveyor.
c. Provide Over-Height indication signal at the respective MCP Touchscreen Terminal, and

Copyright © 2018 by BNP Associates, Inc. (BNP)

PC-type Computer Terminal Workstation.

d. Provide an Oversize indicator lamp in the control station. Illuminate the Oversize indicator lamp in the control station if an over-height bag is detected.

e. Program the oversize circuit to require the following sequence to reset:

1.) Actuate associated E-stop on the respective Control Station

2.) Clear the photocell by removing or re-positioning the over-height bag. At this point the photocell is cleared, the Oversize indicator lamp shall flash to indicate the fault condition has been cleared and the conveyor is ready to be reset.

3.) Reset the E-Stop (if required) and actuate the respective Control Station's "Reset/Start" pushbutton to restart the conveyor segment; at this point the Oversize indicator lamp shall extinguish and the fault on the PC-type Computer Terminal Workstation and the associated MCP Touchscreen Terminal shall be cleared.

6. Over-Length Detection

a. Provide Over-Length detection photocells at the Ticket Counter input belts to the system (TC1 and TC2) as well as to the Outbound Transport Line (OT1) to detect bags that are too long to be processed through the standard conveyor line. These photocells shall be set at the maximum bag length the BHS will accept (i.e., 54").

b. Program the over-length measurement circuit to stop the conveyor if a preset bag length (adjustable in the PLC) is exceeded.

c. Provide Over-Length indication signal at the PC-type Computer Terminal Workstation(s) and the associated MCP Touchscreen Terminal.

d. Provide an Oversize indicator lamp in the control station. Illuminate the Oversize indicator lamp in the control station if a preset bag length (adjustable) is exceeded.

e. Program the over-length circuit to require the following sequence to reset:

1.) Actuate associated E-Stop on the respective Control Station

2.) Clear the photocell by removing the over-length bag. At this point the photocell is cleared, the Oversize indicator lamp shall flash to indicate the fault condition has been cleared and the conveyor is ready to be reset.

3.) Reset the E-Stop (if required) and actuate the respective Control Station's "Reset/Restart" pushbutton to restart the conveyor segment; at this point the Over-Length indicator lamp shall extinguish and the fault on the PC-type Computer Terminal Workstation and the associated MCP Touchscreen Terminal shall be cleared.

4.) Clear the fault on the PC-type Computer Terminal Workstation and the associated MCP Touchscreen Terminal.

7. Merge and Priority Control

a. 45° Merges

1.) Merge windows shall be dynamic in that the control system establishes a window only upon indication that a bag has arrived at either the merge or through line induction photocell (i.e., a fixed window control system will not be acceptable). Merge windows shall be variable and shall be established on the basis of bags per minute (BPM) throughput requirements per subsystem with associated window spacing. Bag length shall be measured by the control photocells to adjust the merge window length as required.

2.) Photocells, timers and appropriate control stations shall be located on the conveyor equipment in 45° merge situations with functionality as follows. For all intents and purposes for this project, the conveyor subsystem onto which bags are to be merged shall be referred to as the primary subsystem, while the conveyor subsystem(s) from which bags are merged from shall be referred to as the secondary subsystem(s):

a.) A photocell shall be located at the discharge end of the secondary subsystem(s) merge conveyor(s). This photocell shall have the functions of jam detection, head end sensing and priority control. The jam detection function of this photocell shall detect a jam at the merge point resulting from

Copyright © 2018 by BNP Associates, Inc. (BNP)

bags being transferred from the secondary subsystem(s) onto the primary subsystem. When this occurs, both belts involved shall be stopped until the jam is cleared (along with other appropriate conveyors upstream that will cascade stop as necessary).

b.) All 45° merge conveyors are to be programmed in a run on demand mode and use energy management timers to stop. As a bag is transported towards the merge conveyor an auto-start photocell, located on the upstream conveyor, once blocked will actuate the start-up of the merge conveyor. If after 20 seconds (adjustable in the PLC) the auto-start photocell doesn't detect any baggage, then the merge conveyor shall stop.

c.) Merge window logic in the PLC is used to monitor and track the flow of bags on the primary conveyor subsystem upstream of the merge. The merge window logic shall use a photocell and timer to measure bag length in order to determine the required merge window for proper transfer onto the primary subsystem. The merge window logic is used to track the position of bags and the space between the bags on the primary subsystem. The head end photocell on the conveyor immediately upstream of the merge conveyor on the secondary subsystem(s) shall be used to measure the length of bags as they move onto the 45° merge. The PLC utilizes this length to calculate the bag window size required for baggage to merge onto the primary subsystem. If the required bag window is determined to be available on the primary subsystem then the bag is not stopped and is merged onto the primary subsystem. If the bag window is determined to be unavailable, then the bag is stopped and held on the merge conveyor until the appropriate size window is detected on the primary subsystem.

d.) The merging function shall be provided in two modes. Primary priority and reverse priority.

(1.) In primary priority mode (to be considered normal mode of operation) bags on the primary conveyor subsystem shall have priority over bags on the secondary conveyor subsystem(s). The secondary subsystem(s) will have to wait to merge onto the primary subsystem for openings between bags on the primary subsystem. Priority control shall monitor the time in which the photocell on the primary subsystem is being blocked, indicating that the appropriate merge window is being searched for.

(2.) Reverse priority mode shall be actuated in two different cases. First, if the 45° merge conveyor is stopped with bags in queue upstream (to a point which will be determined in design review meetings based upon criteria such as but not limited to subsystem length and BPM requirements) then the secondary subsystem(s) is (are) considered to be full and the reverse priority function shall be actuated for the period of time it takes to empty the secondary subsystem(s) of bags from the point in which the reverse priority was actuated. Second, if a bag is on the 45° merge waiting for a window and an opening is not detected for 60 seconds (adjustable in the PLC) then reverse priority shall also be enabled. The primary conveyor subsystem onto which bags are being merged shall be stopped, and all merge control functionality of the secondary subsystem(s) shall be disengaged to allow for continuous and uninterrupted baggage flow from the secondary subsystem(s) onto the primary subsystem for 60 seconds (adjustable in the PLC), thus purging the secondary subsystem(s) of bags. Upon completion the merging function will revert back to primary priority mode.

e.) In the event that there are multiple merges onto the primary subsystem each merge should receive equal priority in order to prevent any one of the merges from not being able to discharge bags onto the primary subsystem.

Copyright © 2018 by BNP Associates, Inc. (BNP)

8. Auto Start

    a. Provide Auto Start photocells upstream of sections of transport conveyors not specifically controlled by START/STOP switches. The same photocell may control both Auto Start and Auto Stop circuits.
    b. Program Auto Start circuits to start a string of conveyors whenever an Auto Start photocell is interrupted.
    c. Before any conveyors may be started, audible start-up warning alarms shall be actuated, audible throughout the area to be affected by the starting of the conveyors. Activation of the alarms shall be through the PLCs. The horn shall sound and after a period of between 5 and 25 seconds (adjustable in the PLC) the conveyor subsystem shall start.
    d. Each conveyor in the subsystem shall be sequentially started from output to input point with an appropriate delay between each motor starter actuation as to ensure electrical power surges are minimized. The next sequence of conveyors controlled by Auto Start functionality shall start in a similar manner, triggered by baggage at a predetermined location within the line.

9. Auto Stop (Time-Out)

    a. Provide Auto Stop photocells upstream of sections of transport conveyors not specifically controlled by START/STOP switches. The same photocell may control both Auto Start and Auto Stop circuits.
    b. Program Auto Stop circuits to stop a string of conveyors if an Auto Stop photocell does not sense a bag for an adjustable time period (adjustable in the PLC).
    c. If a conveyor stops for any reason, reset the auto stop timer and hold until the conveyor restarts.

10. Indexing Control (Accumulation)

    a. Provide a photocell at the discharge end of each conveyor feeding an indexing conveyor / series of indexing conveyors.
    b. Program the indexing conveyor(s) to run when the photocell is blocked and to stop when it is clear.
    c. Include a time delay so that the conveyor can be programmed to continue for a preset interval after a bag clears the photocell and is completely on the indexing conveyor.
    d. Provide a second photocell at the discharge end of an indexing Runout conveyor / at the discharge end of the final indexing conveyor to detect when an item has blocked the ‘Full’ sensor. When the Full photocell is blocked, the Runout conveyor(s) shall not run until the Full photocell is unblocked.

C. Motor Overloads

1. Size the motor overload heaters not to exceed 115% of the full load amps as indicated on motor nameplate.
2. In the event of any subsystem motor drawing excess current, appropriate protection shall be provided to isolate supply to all subsystem elements. Either the single "motor overload" indicator on the affected MCP panels shall illuminate, or if individual “motor overload” indicators are specified for each drive then the effected drive indicator will illuminate.
3. Following rectification of the cause of the overload and resetting of the overload protection device in the motor control panel or motor control center as applicable, the system may be restarted by actuation of the "start" button, at which stage, the "motor overload" indicator shall be extinguished, and normal control shall resume.
4. "Motor overload" fault conditions shall be reported both visually and audibly on the MCP Touchscreen Terminal and the PC-type Computer Terminal Workstation.
5. In the event of individual conveyor motor overloads, all upstream conveyors shall revert to cascade stop mode, while all downstream conveyors shall continue to run in normal mode of operations.

D. Jam Indication/Restart

1. Provide an Illuminated Amber Jam Light (in a common enclosure with an Emergency Stop

Copyright © 2018 by BNP Associates, Inc. (BNP)

Pushbutton and green reset/restart pushbutton) adjacent to all jam detection photocells as follows:

a. As a minimum, provide jam detection photocells and a jam indicator with a jam/reset-restart/emergency stop control station in areas that have a relatively high frequency of jams. This shall include but not be limited to the discharge ends of all conveyors feeding onto power turns, spiral turns, at the bottom of incline and decline conveyors, at all merges for both the primary and secondary subsystems, opposite all, Fire/Security Door locations, and at any other location where experience indicates a potential jam point.

2. Illuminate the Jam Lamp in a steady burning mode and the MCP Amber Fault Flashing Stack Lamp when the jam detection photocell senses a jam condition.
3. Restart the conveyor (after warning alarm sequence) and extinguish the respective Control Station's Jam and E-Stop indicator lamps along with the MCP fault and E-stop Flashing Stack Lamps only after the following sequence:

a. Actuate (push in) Emergency Stop pushbutton; at this point the E-Stop indicator lamp on the respective Control Station shall illuminate in a steady burning mode, and the MCP E-stop flashing stack lamp shall turn on at the MCP.
b. Clear the jam condition; at this point the Jam indicator light shall turn off to indicate the fault condition has been cleared and the associated conveyor segments are ready to be reset.
c. Reset (pull out) emergency stop pushbutton; at this point the E-Stop indicator lamp shall flash to indicate "E-stop Reset" required.
d. Depress the respective Control Station's green "re-start" pushbutton to restart the subsystem conveyor equipment; at this point the E-Stop indicator lamp shall extinguish along with the MCP fault and E-stop flashing stack lamps and the subsystem conveyor equipment shall restart after the appropriate warning alarm sequence.

4. Paint the control station enclosure with "Safety" yellow paint and label with the conveyor Item Designations of the conveyors being controlled in 1/2" high block letters. Jam detection reset control stations shall be placarded with the conveyor designations, which are being controlled.
5. In most cases the control stations shall be located adjacent to the conveyors under control and shall be accessible only to the personnel clearing the jam to avoid a subsystem being re-started in an unsafe condition (e.g. personnel on conveyor). Note that all such control stations shall be located on the catwalk side of conveyors so equipped with catwalks.

E. Start-Up Warning

1. Provide amber flashing stack lamps and audible horn alarms as start-up warnings in areas as specified.
2. Activate the flashing stack lamps and the horn for an adjustable period of time prior to the start-up of the conveyor system.
3. Appropriate audible start-up warning alarms shall be provided at public areas such as the ticket counter load points, TSA work areas (e.g., ticket counter runout and outbound transport clear bag input), and the make-up device.

F. Alarm Silence

1. Provide an ALARM SILENCE momentary contact pushbutton on the door of the MCP which, when depressed, shall silence the audible alarm. The design of the control circuitry shall be such that multiple faults shall always sound the associated fault warning alarm; i.e., if a jam condition has caused the alarm to have been sounded and the alarm has been silenced by the act fault but has not yet been corrected, a second fault occurring after the alarm has been silenced shall again cause the fault warning alarm to sound.
2. Do not extinguish the illuminated fault indicator until the fault has been corrected.

G. Emergency Stop Pushbuttons

1. Locate Push buttons as required to ensure that operating and maintenance personnel can easily and quickly reach an Emergency Stop Pushbutton from anywhere in the system. In addition, ensure that Emergency Stop Pushbutton are installed at the following locations:

Copyright © 2018 by BNP Associates, Inc. (BNP)

a. Around the perimeter of the make-up device.
b. At each end of load/unload conveyors.
c. Along lengths of conveyors, whether running at floor level or overhead mounted on conveyor support legs or building columns a maximum of 50' apart.
d. In each jam indication enclosure.

2. 45° merge Emergency Stops shall also be interlocked to the receiving or takeaway conveyor.
3. Wire all Emergency Stop push buttons for a single subsystem in series with the coils of one or more emergency stop relays. Size the normally open contacts of the relays in series with the power source of the PLC output module(s) controlling the conveyors in the subsystem. The PLC shall not be required to remove power from the associated conveyors for an emergency stop condition.
4. Upon actuation of an Emergency Stop Pushbutton, stop the associated conveyors in the subsystem, illuminate the lamp in the head of the Pushbutton in a steady burning mode, and illuminate the red emergency stop fault flashing stack lamp at the MCP.
5. Restart the conveyors (after the warning alarm sequence) and extinguish the respective Control Station's E-stop indicator lamp and MCP fault flashing stack lamp only after the following sequence:

    a. Reset (pull out) emergency stop pushbutton; at this point the E-stop indicator lamp extinguishes and the Jam indicator lamp on the respective Control Station shall flash to indicate "E-stop Reset" required.
    b. Depress the respective Control Station's green "Re-Start" pushbutton to restart the subsystem conveyor equipment; at this point the Jam indicator lamp shall extinguish, the MCP fault flashing stack lamp shall turn off and the subsystem conveyor equipment shall restart after the appropriate warning alarm sequence.

6. When a jam has been detected and an Emergency Stop pushbutton in the jam indication enclosure is activated, follow the same sequence of stopping the conveyors and illuminating the light in the head of the pushbutton, but do not activate the fault warning circuits at the MCP.
7. When the normal re-start switch for the conveyor is actuated, extinguish all emergency stop pushbutton push-button lamps within the subsystem associated with that particular emergency stop actuation, actuate the start-up warning alarms and, after a delay, start all conveyors in the subsystem.
8. Note that the activation of an Emergency Stop pushbutton switch must not close any powered fire/security door within the area of control of the Emergency Stop switch (i.e., doors shall remain in the state that they were in when the E-stop was activated).
9. "E-Stop" conditions shall be provided with "Reset Required Alarms" and reported both visually and audibly on the PC-type Computer Terminal Workstation and the associated MCP Touchscreen Terminal.
10. Paint the control station enclosure with "Safety" yellow paint and label with the conveyor Item Designations of the conveyors being stopped by this emergency stop in 1/2" high block letters.

H. Control Stop/Start Crossover Control Stations

1. Provide Control Stop/Start control stations at the conveyors/makeup device crossovers to ensure that BHS maintenance personnel can easily and safely reach the equipment for scheduled maintenance as well as in case of jams or faults.
2. Each Control Stop/Start control station shall have a two device control station installed adjacent to the crossover on both sides of the conveyor/make-up device (a total of two control stations per crossover):

    a. One device of the control station shall be a red momentary contact Stop pushbutton switch to stop the conveyor/make-up device and allow personnel to crossover it while the conveyor/make-up device is stopped. Upstream conveyors with baggage arriving at their head end photocell shall cascade stop while the crossover conveyor/make-up device is under a Control Stop condition.
    b. One device of the control station shall be a green momentary contact reset/restart pushbutton switch to restart the conveyor/make-up device after the personnel have crossed over it while the conveyor/make-up device was stopped. Note that the conveyor/make-up device under the crossover shall not start if the conveyor is stopped for another fault condition (such as

Copyright © 2018 by BNP Associates, Inc. (BNP)

jammed or emergency stopped).

3. Upon actuation of a Control Stop pushbutton, there shall be an indication on the MCP Touch Screen Terminal and PC-type Computer Terminal Workstation that the conveyor/make-up device has been stopped for greater than thirty (30) seconds if the associated Control reset/restart pushbutton has not been pressed to start the conveyor/make-up device after the personnel have crossed over. This shall notify operators that the subsystem has a stopped conveyor/make-up device that requires activation of one of the Control reset/restart pushbutton located at the crossover.

I. Security/Fire Door

1. Provide a photocell to detect bags under the security/fire door.
2. The door is to be equipped with either a limit, photocell or proximity switch mounted in such a manner so that the "fully open" position of the door is sensed. If the door is sensed by the limit or proximity switch not be in the fully open position, the associated conveyor shall be stopped if running or shall not be permitted to start if the conveyor is not already running. Note that this limit or proximity switch is in addition to those limit or proximity switches provided with the door operator if the door is powered.
3. The subsystem security doors shall open and close consistent with the respective subsystem start-up and shutdown sequence. The subsystem fire door's normal state shall be in the open position and close only upon detection of fire/smoke, per the appropriate interface with the fire alarm system. The BHS controls for the fire door and the associated subsystem(s) shall interface with the fire/security system, as required, to provide the response to the fire alarm requirement for door closure (with related control functionality to stop the associated conveyor subsystem).
4. The door shall also be equipped with a limit, photocell or proximity switch mounted in such a manner so that the "fully closed" position of the door is sensed. If the door is sensed by the limit or proximity switch not be in the fully closed position, annunciation shall be sent to the system fault monitoring system for rectification of the problem. Note that this limit switch is in addition to those limit or proximity switches provided with the door operator if the door is powered.
5. Interface and test the door interface with the building Fire Alarm and Access Control Systems for door open/closed status, as it relates to the local fire/heat/smoke detectors and/or fire suppression system water flow module(s) and coordinated building fire alarm and security zones.
6. Program the Fire/Security door to operate as follows:

    a. Normal Start/Stop

        1.) Start: Open the security/fire door immediately if the door is not currently open. Ticket counter inputs require a card swipe or key switch permissive start. The BHS PLC to provide Building Access Control System with "Running status".
        2.) Stop (Fire/Security Door or Security Door):

            a.) Run the feeding conveyor for one minute, stop the conveyor and lower the Fire/Security door. The BHS PLC shall be programmed/ interfaced to provide the Building Access Control System with "Door Closed" status.
            b.) If a bag is detected under the door via the door clear photocell, continue to run the conveyors until the photocell is clear and reattempt to close the door. The door should continue attempting to close, however an alarm should be displayed on the BHS fault monitoring system that the door has failed to close after the third attempt.

        3.) Stop (Fire/Security Door Only):

            a.) The fire door shall remain in the open position when the conveyor subsystem stops due to either Manual or Auto Stop controls functionality. The fire door shall close only upon detection of fire/smoke per the appropriate interface with the building fire/security system.
            b.) Upon detection of fire/smoke, if an obstruction is not detected within the door's right-of-way, stop the conveyors and lower the fire door. The BHS PLC to provide Building Access Control System with "Door Closed" status.
            c.) If an obstruction is detected under the door via the door clear photocell,

Copyright © 2018 by BNP Associates, Inc. (BNP)

continue to run the conveyors until the door clear photocell is clear and reattempt to close the door. The door should continue attempting to close, however an alarm should be displayed on the fault monitoring system that the door has failed to close after the third attempt.

b. Upon fire detection:

1.) Close the dry contact
2.) If no bag is detected under the door by either the clear photocell stop all conveyors and close the door.
3.) If a bag is detected under the door by either the door clear photocell run the conveyors until the photocell is clear and immediately stop the upstream and downstream conveyors to allow the door to close. If the door is unable to close upon detection of a fire signal or system stop signal an alarm shall be displayed on the fault monitoring system that the door has failed to close.

c. A security/fire door control station shall be installed adjacent to each security/fire door for maintenance personnel use only (not accessible from the public side) which shall contain the following:

1.) Maintenance/Auto Switch
2.) Emergency Stop
3.) Reset/Restart Green Pushbutton
4.) Door Open Black Pushbutton
5.) Door Closed Black Pushbutton
6.) "Jam" Amber Indicator Light.

d. When the Maintenance/Auto is in the Maintenance position, the door open and door-closed switches are active. Related conveyor systems are not active when in the maintenance mode. Activation of the ticket counter security card swipe is not required when in the maintenance mode.

e. All powered security/fire doors must be equipped with a manual release mechanism to permit the disengagement of the door drive unit so that the door can be either raised or lowered.

J. Fault Warning Alarm

1. Provide an audible/visual alarm on the MCP controlling the system.
2. Activate the alarm and one of the following indicator lights whenever any fault has caused a section of conveyor to stop or prevent it from starting:

Condition	Color
Jam	Amber
Motor Overload / VFD Fault	Blue
Emergency Stop	Red

K. Motor Safety Disconnect (MSD)

1. Provide Motor Safety Disconnect Switches as described in part 2 of this specification.
2. Rotation of the MSD to the off position shall cause the conveyor or other component to stop and appropriate alarm/statuses to be displayed on the MCP Touchscreen Terminals and the PC-type Computer Terminal Workstation as described in Part 2 of this specification.
3. Rotation of the MSD to the On position shall allow the conveyor or other component to restart (with appropriate startup alarm) only if:

a. The conveyor does not pass through a wall or floor penetration.
b. The conveyor is not a public area conveyor.

L. Breakaway End Cap Safety Guard Interlock

1. Provide a failsafe breakaway end cap safety guard interlock on all run out/unload conveyors such as TC1-14 which shall immediately stop the conveyor and prevent injury to personnel and damage

Copyright © 2018 by BNP Associates, Inc. (BNP)

to baggage.

2. Activation of the end cap safety guard interlock shall be displayed on the MCP Touchscreen Terminals and PC-type Computer Terminal Workstation(s) fault monitoring system.
3. When resetting the tripped end cap interlock, the operator shall go through the normal startup procedure following all safety procedures described in these specifications.

M. Interlocks

1. Provide Failsafe interlocks and limits in the system to ensure safe operation. Assume responsibility for the integration of all interlocks and limits that may be necessitated by the characteristics of the elements selected for combination into a total system. Interlocks and limits shall be included for the protection of personnel, equipment and baggage, and in the performance of the operational functions specified for the subsystem and elements comprising the system.
2. Provide electrical interlocks between the various conveyors in a subsystem to inhibit a conveyor from discharging baggage onto a stopped conveyor. Interlocks shall be cascaded from the last conveyor in a train to the first. This provision shall apply to all subsystems even if two different suppliers provide the equipment under separate contract.
3. Provide warning signals, which are activated automatically upon start-up, where appropriate. Flashing lights shall be visible from all points in the vicinity of the equipment concerned. Alarms shall be audible within the equipment vicinity and each alarm in the system must be distinctive from any sound within the hearing range and shall not be unduly annoying to working personnel and shall comply with all applicable codes and regulations. Although not specifically mentioned in the control subsystem descriptions all automatic start-up functions shall be preceded with appropriate audible and visual indicators unless otherwise specified.
4. Inhibit further equipment action upon sensor failure should personnel safety be in doubt. Inform the involved equipment operator or maintenance personnel of such failure through the PC-type Computer Terminal Workstation and the associated MCP Touchscreen Terminal. Sensors shall be selected and positioned such that false signals from debris, ambient light, and personnel movement do not cause activation.
5. Coordinate the facility fire zones with the Architect and to add a dry contact to the subsystems controls, so that if a fire is detected the system will perform the necessary shutdown. This feature shall be provided to the BHS control system, regardless if the system includes a fire door or not.

N. Run Lanyards (RL)

1. Provide pull-to-run conveyor advance control lanyards in non-public operational areas, e.g., for conveyors such as the TC1-13/-14 conveyors, as detailed on the contract drawings and as coordinated with the Owner or their Representative.
2. Activation of the advance control shall cause the related conveyors to run for as long as the control is activated or until the respective pier full photocell is blocked.
3. The run lanyard cable shall be color coded – Green
4. Support the installation of the lanyard on stanchions over the TC1-13/-14 conveyor.

O. E-Stop Lanyards (ESL)

1. Provide E-stop control lanyards in non-public operational areas (e.g. TSA's Runout conveyors TC1-13/-14, as an alternate to emergency stop pushbuttons).
2. Activation of the e-stop control shall cause the related conveyors to stop for as long as the control is activated.
3. The e-stop lanyard cable shall be color coded – Red
4. Support the installation of the lanyard on stanchions over the TC1-13/-14 conveyor .

P. Swing Down Ladder Advisory/Warning Flashing Stack Light

1. Provide a failsafe interlock with associated swing down ladder to provide:

    a. An Amber flashing stack light as a swing down ladder warning in the vicinity of each swing down ladder, which shall be visible to tug and cart drivers entering the immediate area of the respective ladder.

Copyright © 2018 by BNP Associates, Inc. (BNP)

b. Activation of the flashing stack light shall occur as the swing down ladder is traveling from the full up position to the full down position and be maintained while in the down position.
c. Deactivation of the flashing stack light shall occur when the swing down ladder is in the full up position.

3.7 SPECIAL CONTROLS CONSIDERATIONS

A. Outbound System Input Conveyor (TC1 and TC2) "Manual Start" Sequence

1. Each check-in subsystem shall be initiated to start via a local "Subsystem Start" Security Card Swipe Device. For redundancy purposes if there is a failure in the Security Card Swipe Device, the check-in subsystem shall also be provided with a key switch device. Activation of the security card swipe or key switch device shall supply power to the respective control station, located at the associated conveyor segment area. Actuation of the Subsystem's Illuminated Reset/Start pushbutton (Type 2 or 3) shall energize the respective Visual/Audible warning alarms along the conveyor subsystem, both in the public space and air side, for 10 seconds (adjustable) - e.g., check-in area input conveyor respective sub-system ceiling conveyor right-of-way catwalks and the work aisle(s) of the TSA's screening area. The Fire/Security door shall open while the "Run" 10 second alarm sounds and flashes. After the 10 (ten) second "Run" alarm period and when the Fire/Security door is fully opened, the check-in collection conveyor(s) shall start. The downstream transport conveyors shall start via an auto-start function. The downstream transport conveyors shall all start sequentially from the ticket counter runout conveyors in the TSA's screening area (energized to function under an indexing mode for baggage accumulation) to the input with an appropriate delay between each motor starter actuation to ensure electrical power surges are minimized.
2. The subsystem fire/security doors shall open and close consistent with the respective subsystem start-up and shut-down sequence. Additionally, if the conveyor line is running, the subsystem fire/security doors shall close upon receiving a signal from the Fire Alarm System for closure and open upon via a normal start-up sequence.

B. Outbound Transport Subsystem (OT1) "Manual Start" Sequence

1. The OT1 Outbound Transport subsystem shall be initiated to start via local "Subsystem Start" pushbuttons (Type 5), which shall be located on the load conveyors (one per EDS workstation area) or at the Type 6 control station at the head end of the OT1-02 conveyor. Actuation of the Subsystem's Start pushbutton shall energize the respective Visual/Audible warning alarms along the conveyor subsystem, both in the TSA screening area and along the outbound baggage make-up area, for 10 seconds (adjustable). After the 10 (ten) second "Run" alarm period the input/load conveyors shall start. The downstream transport conveyors and make-up device shall start via an auto-start function. The downstream transport conveyors shall all start sequentially from the output to the input with an appropriate delay between each motor starter actuation to ensure electrical power surges are minimized. The start-up warning signal at the make-up device shall sound only if the device is not already running.

C. System Ready Indication

1. A green indicator light, labeled SYSTEM READY and located on the door of each MCP shall serve to indicate that the devices under its control are ready to operate upon receipt of a START signal, from the BHS control system and local card swipe device. To accomplish this, the light shall illuminate under the following conditions, as applicable to the respective subsystem:

a. Power is applied to the MCP.
b. The local conveyor motor and Fire/Security door disconnect switches are in the "ON" position.
c. All Emergency Stop pushbuttons are reset.
d. No Motor overloads are tripped.
e. No Motor Safety Disconnects are turned off
f. No Jam conditions are indicated
g. No Oversize conditions are indicated.

Copyright © 2018 by BNP Associates, Inc. (BNP)

h. No faults are indicated on the PC-type Computer Terminal Workstation, the subsystem's MCP, and associated MCP Touchscreen Terminal.

D. Keypad Swipe Security Switch

1. Provide a 1" conduit knockout on the TC1 and TC2 subsystem control stations that require interfacing with the Airport's Card Swipe Modules, to allow a keypad/card swipe security switch to be mounted on the subsystem control panel back-plate. Provide all required interlocks to provide a fully integrated Building Access Control System. Coordinate with the Building Access Control System manager.

3.8 BHS DETAILED CONTROL DESCRIPTIONS/REQUIREMENTS

A. General Design Requirements

1. The paragraphs that follow reference the functional and operational requirements that are relative to the respective subsystems. Reference Parts 1 and 2 of this specification for specified requirements regarding MCP/PLC Cabinets with associated Touchscreen Terminals, and PC-type Computer Terminal Workstation with required interface requirements between the Baggage Handling System and the Building Fire Alarm and Access Control Systems. System wide control functions are described in detail elsewhere in this document; reference Part 2 "Electrical Technical Requirements" and Part 3 controls paragraphs, describing in detail the "System Control Requirements" and "Special Controls Considerations". The following subsystem control descriptions apply the referenced components and circuits to the operational aspect of the system and specify the actual elements under their control.
2. By means of suitable computer dialogue at the MCP Touchscreen Terminal / PC-type Computer Terminal Workstation keyboard (or by Mouse manipulation and using pull-down menus) it shall be possible to inhibit the operation of conveyor equipment and to individually override automatic control of a conveyor, in response to a variety of conditions, such as baggage jams or equipment failure, which may allow a conveyor line to run despite a sensor or other such failure. An appropriate graphical and text display shall be provided for conveyors in this "override" mode of operation. Override control shall require appropriate high level password protection. Any overridden condition shall be prominently annunciated on the PC-type Computer Terminal Workstation. Startup warning and e-stop functionality shall remain intact despite an override condition. Neither public area conveyors nor fire/security doors at the public area shall have override capability. Coordinate the specific override requirements and functionality with the Owner or their Representative.
3. In each case an operator, having access to the proper passwords at the respective MCP Touchscreen Terminal / PC-type Computer Terminal Workstation, as an example, shall be able to:

   a. Activate a conveyor.
   b. Shut down a conveyor (such as ticket counter load conveyors).

4. Reference the Contract Drawings for conveyor equipment motor control panel and subsystem breakdown/indication. Location for each MCP is referenced on the BHS Partial Plan and Control Plan Drawings. The power supply for the 480VAC BHS Motor Control Panel shall be provided as shown on the BHS Partial Plans and consistent with the power distribution requirements of Division 26
5. The Control Functions associated with the BHS are described in the following paragraphs. Apply the generic subsystem/conveyor functional description to the detail design of each electrical subsystem of similar type.
6. Provide software for the control system reflecting the sequence of operation for each subsystem as described in the following paragraphs. The paragraphs describe the particular subsystem specific controls that shall be required in addition to those standard controls (i.e., Jam Detection, Jam Reset, Cascade Stop, Oversize Detection, Merge Control, Auto Start, Auto-Stop, Emergency Stop, and all other controls functionality described elsewhere in this document) that shall be required for each subsystem.
7. Provide a dry contact to the subsystem controls, within each respective BHS MCP cabinet, as specified elsewhere in this document, so that in the event that an appropriate signal is sent from the

Copyright © 2018 by BNP Associates, Inc. (BNP)

Fire Alarm system (as coordinated with the fire alarm system), the conveyor system shall shut down and the associated fire doors shall close.

8. All Jam Reset and Emergency Stop Control Stations shall be located on the maintenance catwalk/walkway side (e.g., drive assembly), as coordinated with the Owner or their Representative. All BHS Control Stations shall be accessible by maintenance and operational staff.
9. The functionalities described for the subsystems below represent only one of the originating outbound subsystems that are associated with this project and is provided as an example. Such functionalities shall be provided for all alike subsystems related to this project. Detailed control functionality for each subsystem shall be coordinated with the Owner or their Representative through the shop drawing submittal process.

B. Ticket Counter Transport Subsystems

1. General

a. The outbound ticket counter subsystems consist of the TC1 and TC2 conveyor lines. The following describes the TC1 ticket counter subsystem sequence of operation.
b. The outbound TC1 and TC2 conveyor subsystems shall be constructed within both the Departures/Arrivals Level and Basement Level to transport unscreened baggage to the indexing runout conveyors in the TSA's screening area in the Basement Level. The TC2 subsystem shall merge into TC1 subsystem. The TC1 conveyor segments shall be powered from the MCP-TC1 Motor Control Panel and the TC2 conveyor segments shall be powered from MCP-TC2 Motor Control Panel. These subsystems shall be controlled by "Cold Back-up" redundant outbound PLCs.
c. All fault annunciation and status reporting for the outbound ticket counter conveyor subsystems shall be displayed both graphically and in text on the PC-type Computer Terminal Workstation and respective MCP Touchscreen Terminal.
d. Reference the BHS Controls Drawing Sheets in the B-600 series for the layout and definition of the related subsystem controls and their respective MCP.
e. Coordinate with the building security system to integrate the ACS Card Swipe device (Section 281300 – Access Control).
f. The following description for the TC1 ticket counter subsystem sequence of operation is provided as an example; detail control functionality shall be coordinated with the Owner or their Representative through the shop drawing submittal process.
g. This check-in ticket counter and originating outbound baggage transport portion of the subsystem consists of conveyor segments TC1-01 through TC1-14, transporting baggage from the Departures / Arrivals level check-in ticket counters to the TSA's screening area in the Basement level.
h. Motor Control Panel MCP-TC1 shall power and control the following conveyor segments and associated equipment:

1.) All TC1 conveyor segments
2.) Fire/Security Door FSD/TC1-03

2. Control Equipment Components

a. Provide control stations with their respective control devices and functions for the TC1 conveyor subsystem to accommodate the requirements relating to the Jam Reset Control Function (i.e. Type 1), Emergency Stop Control/Reset (i.e. Type 8), Fire/Security Door Control (i.e. Type 4), and MCP Control Station (i.e., Type 10), along with the following subsystem specific control stations.
b. Jam Reset and Emergency stop control station(s) location and function shall be consistent with the specified requirements indicated elsewhere in this document. All Jam Reset and Emergency stop stations associated with the TC1 subsystem conveyors shall be located adjacent to each conveyor drive on the maintenance side, so that they are accessible by maintenance personnel. For conveyor segments that are accessible on either side from the floor level (e.g., TC1-13 and TC1-14), provide an Emergency Stop Lanyard operated limit switch with its manual reset and padlock attachment, as specified elsewhere in this document, mounted above the conveyor on stanchions, as coordinated with the Owner or their

Copyright © 2018 by BNP Associates, Inc. (BNP)

representative.

c. At a minimum, two control stations shall be provided for the start/stop control of the TC1 ticket counter conveyor subsystem; one at the charge end of each ticket counter takeaway conveyor line and one at the discharge end. Coordinate the location(s) for all control stations with the Owner or their Representative in conjunction with the BHS contract drawings and the following requirements:

d. A Type 2 control station, which shall be located at the charge end of the TC1-01 conveyor and stanchion-mounted. Coordinate the exact installation location and mounting with the Owner or their Representative and other building/construction disciplines. The Type 2 control station shall include the following operators/control devices:

1.) Lighted "System Start/Reset" Green Pushbutton
2.) "System Stop" Red Pushbutton
3.) Lighted Push-Pull (Lockable) “E-Stop” Illuminated Red Maintained Contact Pushbutton
4.) Sonalert Warning Device
5.) “Jam” Amber Illuminated Indicator Light
6.) Start Key Switch
7.) ACS Security Card Swipe device (Section 281300 – Access Control)

e. A Type 3 control station, which shall be located at the discharge end of the TC1-02 conveyor, adjacent to the fire/security door, and stanchion-mounted. Coordinate the exact installation location and mounting with the Owner or their Representative and other building/construction disciplines. The Type 3 control station shall include the following operators/control devices:

1.) Lighted "System Start/Reset" Green Pushbutton
2.) "System Stop" Red Pushbutton
3.) Lighted Push-Pull (Lockable) “E-Stop” Illuminated Red Maintained Contact Pushbutton
4.) Sonalert Warning Device
5.) “Jam” Amber Illuminated Indicator Light
6.) “Oversize” White Illuminated Indicator Light
7.) Start Key Switch
8.) ACS Security Card Swipe device (Section 281300 – Access Control)

3. Control Functions

a. Ticket Counter Conveyor Start Sequence:

1.) Initial Settings - the system ready indication for the initial conditions of the subsystem(s) shall be as described above in this Specification Section (347739, Paragraph 3.7.C).
2.) The conveyor subsystem's local "Subsystem Start" shall be enabled via the "System Start" function, from the PC-type Computer Terminal Workstation / MCP Touchscreen Terminal. This function shall allow the local "Subsystem Start" security card swipe to supply power to the respective TC1 subsystem Start/Stop control stations.
3.) Subsystem Initial Start-up (“Manual Start”):

a.) The Ticket Counter conveyor subsystem activation shall be permitted by ACS following a security card swipe of an authorized user or via activation of the Start key switch. One of these actions shall supply power to the pushbutton control stations located at the Ticket Counter area. Actuation of the Subsystem's Illuminated Start push button within 30 seconds (adjustable) of receiving the appropriate ACS signal shall energize the conveyor subsystem’s Visual/Audible warning alarms along the conveyor subsystem right-of-way, both in the public space and air side, for 10 seconds (adjustable). The subsystem’s respective Fire/Security door, as illustrated in the BHS contract drawings, shall open while the start-up alarm sounds and flashes. After start-

Copyright © 2018 by BNP Associates, Inc. (BNP)

up warning alarm period and when the fire/security door is fully opened, conveyor segments TC1-01 through TC1-04 (i.e. the end of the auto-start zone) shall start in a reverse cascade fashion.

4.) Automatic System Cascade Start:

a.) The conveyor segments downstream of TC1-04 shall start via an “Auto Start” sequence. Provide auto start photocells upstream of the outbound transport conveyor sections, not specifically controlled by the “Start/Stop” control station. Program the auto start circuit to start conveyor segments TC1-05 through TC1-12 plus the ticket counter runout conveyors in the TSA's screening area which shall be energized to function under an indexing mode for baggage accumulation, if they are not already running, whenever the auto start photocell is interrupted. The downstream TC1 transport conveyors shall all start sequentially from the output to the input with an appropriate delay between each motor starter actuation to ensure electrical power surges are minimized.

5.) Automatic System Cascade Stop:

a.) The TC1 conveyor segments downstream of TC1-04 shall stop via an "Auto Stop" sequence. Provide auto stop photocells upstream of the outbound transport conveyors that are not specifically controlled by the "Start/Stop" control station. Program the auto stop circuit to stop conveyor segments TC1-05 through TC1-14 whenever the auto stop photocell does not sense a bag for 5 to 30 minutes (adjustable). The same photocell may control both "Auto Start" and "Auto Stop" functions.

b.) The most upstream cascade stop zone (i.e. TC1-01 through TC1-04) shall operate similarly to the zone described above. However, since this zone includes public area conveyors, the “Auto Stop” timer may require a different time period than the rest of the system and shall be coordinated with the Owner or their representative and Airlines.

6.) Manual Stop:

a.) Depressing the "Stop" pushbutton on any of the Ticket Counter Control Stations shall stop conveyors TC1-01 through TC1-04 and close the Fire/security door (if the Door Clear Photocells are not blocked); conveyor segments TC1-01 through TC1-04 shall run for a predetermined period to clear all bags on the conveyor segments, prior to the stoppage of the conveyor segments and closure of the door.

b. Start-up alarms and fault alarms shall be located as required, along the outbound subsystem(s) and make-up device area. Start-up and Fault Warning Alarm(s) location, type and function shall be consistent with the specified requirements indicated elsewhere in this specification section.

c. Jam Reset and Emergency stop control station(s) location and function shall be consistent with the specified requirements indicated elsewhere in this document. All Jam Reset and Emergency stop stations associated with the TC1 subsystem's outbound transport conveyors that are accessible by catwalk/walkway shall be located adjacent to each conveyor drive on the maintenance catwalk/walkway side, so that they are accessible by maintenance personnel. For conveyor segments that are accessible on either side of the catwalk (e.g., TC1-05 through TC1-08), provide an Emergency Stop Lanyard operated limit switch with its manual reset and padlock attachment, as specified elsewhere in this document, mounted above the conveyor on stanchions, as coordinated with the Owner or their Representative. The location of the Emergency Stop control stations and related E-Stop Zones shall be coordinated with the Owner or their Representative.

d. The Ticket Counter conveyors shall be activated by the security card swipe or key switch activation. One of these actions shall provide an input to the associated PLC which shall supply power to the pushbutton control stations located at the Ticket Counter area. Pressing

Copyright © 2018 by BNP Associates, Inc. (BNP)

a "Start" pushbutton on any of the TC1 ticket counter start control stations shall energize the TC1 Start-up alarm(s) in the check-in area, along the outbound ticket counter subsystem and the bagroom for 10 seconds (adjustable). The start-up alarms in the bagroom area shall sound only if the conveyors are not already running. The Fire/Security door shall open while the "Run" 10-second start-up alarm sounds and flashes. After the 10 second "Run" alarm period and when the Fire/Security door is fully opened, the ticket counter check-in conveyors TC1-01 through TC1-04 shall start.

e. Over-Height / Over-Length Detection

1.) An over-height and an over-length photocell shall be provided at the discharge end of TC1-03 on the non-public side of the fire/security door; an oversize indicator light shall be located on the public side, on the Type 3 control station adjacent to the fire/security door opening.
2.) Over-Height: Interruption of the over-height photocell shall immediately stop conveyors TC1-03 and TC1-04 and illuminate the oversize indicator light on the control station; the indicator light shall signify, by a steady burning indication, the Oversize bag condition which shall change to a flashing signal once the fault condition has been cleared. The conveyors shall be restarted by resetting the E-stop and pressing the start pushbutton, as described in section 3.6 (Special Controls Requirements). Upstream conveyors shall cascade stop appropriately if baggage arrives and blocks the associated conveyor(s).
3.) Over-Length: When the over-length photocell has been blocked for a duration greater than the amount of time for an item of maximum length to pass by that photocell, the system shall immediately stop conveyors TC1-03 and TC1-04, and illuminate the oversize indicator light on the control station; the indicator light shall signify, by a steady burning indication, the Oversize bag condition which shall change to a flashing signal once the fault condition has been cleared. The conveyors shall be restarted by resetting the E-stop and pressing the reset/restart pushbutton, as described in section 3.6 (Special Controls Requirements).
4.) Similar to the existing conditions, Over-Height and Over-Length Baggage plus fragile items and live animal cages shall be manually transported to the Oversize screening area located in the Basement level.

f. CS/FSD TC1-03 control station located at TC1-03 (Type 4 – Fire-Security Door Control Station) provides manual control for the fire / security door when in "Maintenance" mode. CS/FSD TC1-03 fire door control station shall be installed adjacent to each fire / security door for maintenance personnel use only (not accessible from the public side) which shall contain the following:

1.) Maintenance/Auto Switch
2.) Door Open Black Pushbutton
3.) Door Closed Black Pushbutton
4.) Reset/Restart Green Pushbutton
5.) "Jam" Amber Illuminated Indicator Light
6.) Lighted Push-Pull (Lockable) "E-Stop" Red Maintained Contact Pushbutton

g. Additionally, provide two (2) Type 19 "Control Stop / Start" Pushbutton control stations labeled CS/TC1-07A, and CS/TC1-07B for the maintenance crossover location (one control station on each side of the crossover), as specified elsewhere in the document.
h. Provide one (1) Type 26 Stack Light module at the maintenance crossover location, as specified elsewhere in the document.
i. One (1) Type 10 control station on the motor control panel (MCP) door shall also be provided. Consistent with the contract requirements this control station shall be labeled as CS/MCP TC1, and include the following controls/features:

1.) "Reset/Restart" Green Pushbutton
2.) "System Ready" Green Illuminated Indicator Light
3.) Lighted Push-Pull (Lockable) "E-Stop" Red Maintained Contact Pushbutton
4.) "Alarm Silence" Black Pushbutton

Copyright © 2018 by BNP Associates, Inc. (BNP)

5.) "Lamp Test" Yellow Pushbutton
6.) "System Fault" Amber Indicator Light
7.) "Motor Overload" Blue Indicator Light

4. Other Control Functions:

a. Control Functions associated with the conveyor subsystem's Fire/Security Door operation, Cascade Stop, Jam Detection/Restart, Oversize Detection/restart, Emergency Stop/Reset, Motor Control Panels, Motor Overload conditions and respective Alarm Silence function(s) shall be compliant with the specified requirements described elsewhere in this specification section.
b. Flash the Ticket Counter Reset/Start Pushbutton "Green light" when the respective ticket counter conveyor subsystem has cascaded back to the load belt. This will notify the ticket counter agent that a downstream jam/fault has occurred in the subsystem.
c. Merge Control functions associated with the TC2 ticket counter conveyor subsystem's 45° merge functionality shall be compliant with the specified requirements described elsewhere in this specification section.

C. OT1 Outbound Transport Subsystem

1. General

a. This subsystem consists of conveyor segments OT1-01 through OT1-05, for transport of baggage that have been screened and cleared from the TSA's Screening Area to the Makeup Unit MU1.
b. The OT1 subsystem shall be powered from the MCP OT1 and controlled by the BHS PLC with cold backup capability.

2. Control Equipment Components

a. The following description for the OT1 outbound transport subsystem and related sequence of operation is provided as an example; detailed control functionality shall be coordinated with the Owner or their Representative through the shop drawing submittal process.

1.) Provide the necessary control stations with their respective control devices and functions for the OT1 conveyor subsystem to accommodate the requirements relating to Jam Reset (Type 1) Control Station, Emergency Stop Control/Reset (i.e. Type 8), and MCP control station (i.e., Type 10) along with the subsystem specific control stations described below.
2.) Start-up alarms and fault alarms shall be located as required, at the input points (OT1-01 and OT1-02), along the transport conveyors, and at the make-up device. Start-up and Fault Warning Alarm(s) location, type and function shall be consistent with the specified requirements indicated elsewhere in this specification section. The location of the alarms shall be coordinated with the Owner or their Representative.

a.) Provide three (3) Type 5 control stations; adjacent to the EDS machine's discharge for clear bags exiting the CT80DR+ / CT80XL on the operator side of OT1-01 and OT1-02. Coordinate the exact installation location and mounting with the Owner or their Representative and local TSA. This control station shall include the following operators/control devices:

(1.) "System Start/Reset" Green Pushbutton
(2.) "System Stop" Red Pushbutton
(3.) Lighted Push-Pull (Lockable) "E-Stop" Illuminated Red Maintained Contact Pushbutton
(4.) "Jam" Amber Illuminated Indicator Light
(5.) Sonalert Warning Device

b.) Provide one (1) Type 6 control station; at the discharge end of OT1-02. Coordinate the exact installation location and mounting with the Owner or their Representative and local TSA. This control station shall include the following operators/control devices:

Copyright © 2018 by BNP Associates, Inc. (BNP)

(1.) "System Start/Reset" Green Pushbutton
(2.) "System Stop" Red Pushbutton
(3.) Lighted Push-Pull (Lockable) “E-Stop” Illuminated Red Maintained Contact Pushbutton
(4.) Sonalert Warning Device
(5.) “Jam” Amber Illuminated Indicator Light
(6.) “Oversize” White Illuminated Indicator Light

b. OT1 Conveyor Start Sequence:

1.) Initial Settings - the system ready indication for the initial conditions of the subsystem(s) shall be as described above in this Specification Section (347739, Paragraph 3.7C).

2.) The OT1 subsystem shall include one mode of startup – manual. To manually start the subsystem, the local "Subsystem Start" (located in the Type 2 or Type 3 control stations) shall first be enabled via the "System Start" function, from the MCP Touchscreen Terminal or PC-type Computer Terminal Workstation. This function shall allow the local "Reset/Start" pushbuttons at any of the associated TSA work areas to start the subsystem.

a.) Subsystem Initial Start-up (“Manual Start”):

(1.) Actuation of the Outbound Transport subsystem's “Reset/Start” push buttons shall energize the conveyor subsystem’s Visual/Audible warning alarms along the conveyor subsystem right-of-way for 10 seconds (adjustable). After start-up warning alarm period, the make-up device and conveyor segments OT1-01 through OT1-05 shall all start sequentially from the output to the input. The start-up warning signal at the make-up device shall sound only if the device is not already running.

a.) Manual Stop:

(1.) Depressing the "Stop" pushbutton on any of the OT1-01 or OT1-02 Control Stations shall stop conveyors OT1-01 and OT1-02; conveyor segments OT1-01 and OT1-02 shall run for a predetermined period to clear all bags on the conveyor segments, prior to the stoppage of the conveyor segments. Conveyor segments OT1-03 through OT1-05 shall stop via the conveyor line's "Auto Stop" sequence described below.

b.) Automatic System Cascade Stop:

(1.) The OT1-01 through OT1-05 conveyor segment shall stop via the conveyor line’s "Auto Stop" sequence whenever the auto stop circuit (i.e., upstream photoeyes) do not sense a bag for 5 to 30 minutes (adjustable).

c. One (1) Type 10 control station on the motor control panel (MCP) door shall also be provided. Consistent with the contract requirements, this control station shall be labeled as CS/MCP OT1, and include the following controls/features:

1.) “Reset/Restart” Green Pushbutton
2.) “System Ready” Green Illuminated Indicator Light
3.) Lighted Push-Pull (Lockable) “E-Stop” Red Maintained Contact Pushbutton
4.) “Alarm Silence” Black Pushbutton
5.) “Lamp Test” Yellow Pushbutton
6.) “System Fault” Amber Indicator Light
7.) “Motor Overload” Blue Indicator Light

3. Control Functions

a. Initial Settings - the system ready indication for the initial conditions of the subsystem shall

Copyright © 2018 by BNP Associates, Inc. (BNP)

be as described above in this Specification Section (347739, Paragraph 3.7C).

b. Provide manual start/stop controls for the conveyors in this subsystems in accordance with these specifications.

4. Other Control Functions

a. Jam Reset and Emergency stop control station(s) location and function shall be consistent with the specified requirements indicated elsewhere in this document. The Jam Reset and Emergency stop station(s) that will be associated with the OT1 conveyors shall be located adjacent to the conveyor drive and positioned so that they are accessible by maintenance personnel.

b. For conveyor segments that are accessible on either side of the screening work area (e.g., OT1-01 and OT1-02), provide an Emergency Stop Lanyard operated limit switch with its manual reset and padlock attachment, as specified elsewhere in this document, mounted above the conveyor on stanchions, as coordinated with the Owner or their Representative.

c. Control Functions associated with the OT1 subsystems' Cascade Stop, Jam Detection/Restart, Emergency Stop/Reset, Motor Overload conditions and respective Alarm Silence function(s) shall be compliant with the specified requirements described elsewhere in this document.

D. Ancillary Subsystems (Make-up Unit)

1. Make-Up Unit (MU1) General

a. The Makeup Unit shall be powered from the MCP OT1 and controlled by the BHS PLC with cold backup capability.

2. Control Equipment Components

a. Provide two (2) Type 14 Make-Up Maintenance Mode Control Stations in close proximity to each of the drive units for use by maintenance personnel only. Consistent with the contract requirements the Type 14 control stations shall be labeled as CS/MU1G and CS/MU1H, and described below with controls/features:

1.) "Jog" Black Pushbutton
2.) "Reset/Restart" Green Pushbutton
3.) "Auto-Maintenance" Two Position Selector Switch
4.) Lighted Push-Pull (Lockable) "E-Stop" Red Maintained Contact Pushbutton
5.) When the Auto-Maintenance Switch is in the maintenance position, the device can move (jog) in the forward direction only when the jog pushbutton is held in.

b. Provide a minimum of one (1) Type 1 Jam Control Station at the OT1 discharge to the MU1 Make-Up Device. This control station shall be mounted on a stanchion and be located so that it is accessible from the outer radius (working area) of the carousel. Consistent with the contract requirements, this control station shall be labeled as CS/MU1A, and as described below with controls/features:

1.) "Reset/Restart" Pushbutton
2.) "Jam" Amber Illuminated Indicator Light
3.) Lighted Push-Pull (Lockable) "E-Stop" Red Maintained Contact Pushbutton

c. Provide a minimum of five (5) Type 13 Make-Up Device Restart Control Stations, located around the perimeter of the Make-Up Device. Consistent with the contract requirements, the control stations shall be labeled CS/MU1B, CS/MU1C, CS/MU1D, CS/MU1E, and CS/MU1F as described below with controls/features:

1.) Lighted Push-Pull (Lockable) "E-Stop" Red Maintained Contact Pushbutton
2.) "Reset/Restart" Pushbutton

d. Additionally, provide a total of four (4) Type 19 "Control Stop / Start" Pushbutton control stations labeled CS/MU1K / CS/MU1L and CS/MU1M / CS/MU1N for the make-up device crossovers locations (one control station on each side of the crossover), as specified elsewhere in the document.

Copyright © 2018 by BNP Associates, Inc. (BNP)

e. Provide two (2) Type 26 Stack Light modules at the make-up device crossover locations, as specified elsewhere in the document.
f. Provide three (3) Type 27 Stack Light modules (within the inside perimeter of make-up device at the center and opposite ends) to alert the Airlines that there is a bag available for pick up at the Oversize slide area or a Live Animal cage that is available for pick up adjacent to the Oversize slide.

3. Control Functions

a. Initial Settings – the system ready indication for the initial conditions of the subsystem(s) shall be as described above in this specification Section (347739, Paragraph 3.7C).
b. The make-up device shall operate by means of auto-start/stop circuits. Additionally, the manual start function described below shall provide the ability to operate the device after the feed conveyor subsystem (OT1) is timed out.
c. The baggage system control circuitry shall be designed to assure that the make-up device is running at full speed prior the startup of any feed conveyors.
d. In case the make-up device times out before all baggage has been sorted, activation of any restart button on the make-up device shall cause the device to run for an additional twenty (20) minutes (adjustable) without the feed conveyors operating.

4. Other Control Functions:

a. Startup alarms and fault alarms shall be located as required, along the MU1 device (in conjunction with the OT1 conveyor feed subsystem), as specified elsewhere in this specification section. Start up and Fault Warning Alarm(s) location, type and function shall be consistent with the specified requirements indicated elsewhere in this specification section.
b. Jam Reset and Emergency stop control station(s) location and function shall be consistent with the specified requirements indicated elsewhere in this specification section. The Jam Reset and Emergency Stop station(s) that will be associated with the OT1 subsystem conveyors and MU1 device shall be positioned so that they are accessible by maintenance personnel.
c. Control Functions associated with the conveyor subsystem's Cascade Stop, Jam Detection/Restart, Emergency Stop/Reset, Motor Control Panels, Motor Overload conditions and respective Alarm Silence function(s) shall be compliant with the specified requirements described elsewhere in this specification section.

E. Ancillary Subsystems (Oversize Slide / Security Door)

1. Oversize Slide (OS1) General

a. The Oversize security door shall be powered from the MCP OT1 and controlled by the BHS PLC with cold backup capability.

2. Control Equipment Components

a. CS/SD OS1 control station (Type 7 – Oversize Security Door Control Station) located at the Oversize slide input adjacent to the Oversize screening area provides manual control for the security door. This control station shall be installed adjacent to the security door for the TSA personnel use only (not accessible from the make-up area) which shall contain the following:

1.) Door Open Black Pushbutton
2.) Door Close Black Pushbutton
3.) Reset/Restart Green Pushbutton
4.) “Jam” Amber Illuminated Indicator Light
5.) "OVERSIZE READY" Black Pushbutton
6.) Lighted Push-Pull (Lockable) “E-Stop” Red Maintained Contact Pushbutton

b. CS/OS1A control station (Type 8 – Oversize Slide Control Station) located at the Oversize slide output in the make-up area provides acknowledgement that an oversize item has been accepted by the Airlines. This control station shall be installed adjacent to the Oversize slide for the Airline personnel use which shall contain the following:

Copyright © 2018 by BNP Associates, Inc. (BNP)

1.) "OVERSIZE ACCEPTED" Black Pushbutton

c. Provide one (1) Type 27 Stack Light module at the oversize slide on the make-up side to alert the Airlines that there is a bag available for pick up at the Oversize slide area or a Live Animal cage that is available for pick up adjacent to the Oversize slide.

3. Control Functions

a. The TSOs in the Oversize screening area have manual control of the Oversize security door via the Door Open and Door Close pushbuttons in the Type 7 control station.
b. When the TSA has completed their screening and has an oversize item or Live Animal cage ready for Airline pickup, the TSO will press the "OVERSIZE READY" pushbutton. This will cause the Type 27 Stack Light modules at the make-up device and at the oversize slide to illuminate to advise the Airlines that an item is ready for pickup outside the Oversize screening area.
c. When the Airline staff member has picked up the item(s), the staff member shall press the "OVERSIZE ACCEPTED" pushbutton to extinguish the Type 27 Stack Light module at the make-up device and at the oversize slide.

3.9 BHS PHASED IMPLEMENTATION

A. General

1. The baggage handling system installation and associated demolition of existing conveyor segments shall be completed in phases. The BHS scope of work (installation, removal and associated interim conditions) shall be in accordance with the overall project phasing sequence, as illustrated in the accompanying BHS drawing package and outlined in this specification. The implementation area for the BHS installation and modifications (as they relate to the interim and final conditions) shall become available as dictated by the overall program phasing plans and coordinated with the Owner or their Representative's schedule. Provide the manpower required to ensure timely completion of the BHS related phases within the specified durations and to minimize subsystem out of service times. BHS Scope of work shall not exceed the specified out of service times that are in the contract documents.
2. Schedule and coordinate the BHS Scope of Work (installation, removal and associated interim connections) in accordance with the Phasing indicated by the project's overall Phasing Plan and the Phasing described in this specification section. Coordinate all work with the Owner or their Representative, other disciplines working in the immediate area of construction, airline flight schedules and hours of operation, so as not to impact the Terminal's normal functions and concurrent airline operations.
3. Installation of conveyor equipment and removal of the existing equipment shall occur simultaneously with on-going airline operations; therefore, it is vital that the outbound operation continues to process baggage throughout the implementation period without operational disruption. Make every effort to ensure continuity of operation in each Construction Phase and related BHS phases, and throughout the entire duration of the Project.
4. Communication shall be an essential element of the Phased Implementation Plan. Under no circumstances shall a new Phase commence without proper notification (according to the schedule(s) in advance and in writing).
5. Short duration system shutdown will be permitted for the changeover from the interim configuration to the final layout. Shutdown of the system during changeover shall be scheduled during times of low impacted terminal operating demands. Check and field verify actual site conditions to determine and coordinate the schedule for any shutdown period. Submit schedule of work to the Owner or their Representative 14 days (min.) prior to the actual work being performed, for review and approval. As noted elsewhere in the Contract Documents, manual handling of baggage will be required during the BHS outages; in this regard, coordinate with the Owner or their Representative the scheduling of these activities and when manual handling of baggage will be required, which shall be performed per the Airport's current baggage screening procedures as reviewed and approved with the TSA. Schedule shall be submitted on a BHS Phase-By-Phase basis and/or subsystem as applicable. Additionally, notification shall be submitted (in writing) to the Owner or their

Copyright © 2018 by BNP Associates, Inc. (BNP)

Representative, consistent with the specified Work Activities Bulletin requirements and in compliance with Division 01, Section 011000 (Summary), prior to any shut-down or interruption of the BHS operations. Ensure that an approval is obtained from the Owner or their Representative before proceeding with the shutdown of the system(s); there shall not be any exceptions to this requirement.

6. All of the work in the Terminal and in areas that may conflict with airlines and TSA operations shall be scheduled and coordinated (installation, removal and interim connections), with airline flight schedules and hours of operation, so as not to impact the Terminal normal functions. The majority of the BHS work shall be performed during the third-shift period. For reference purposes, third-shift work period may be considered between the hours of 8:00pm and 4:00am. However, all of the BHS work shall be performed as coordinated with the Owner or their representative, the Bagroom TSA screening, and the Airline operations. Coordinate, through the Owner or their Representative, the work windows within the BHS operational areas to establish the times during the day and/or night for each BHS Phase, which will also be dependent on the work to be performed so as to allow the BHS Contractor to take down portions of the system for the respective phase. The BHS work shall be performed per the specified BHS Phases. Within each BHS Phase, the BHS Contractor shall have an average of a seven (7) to eight (8) hour work window, to perform his work. The Owner or their Representative will have the right to allocate separate areas of the Terminal, on a daily basis (if necessary), to allow the BHS Contractor to break-up his work window within the coordinated work space(s) that satisfy the allowable work window without compromising the BHS operation. Determine the quantity of work required during the day, including the third shift period, based upon a comprehensive analysis of the existing systems (in coordination with the Owner or their Representative), the necessity to maintain uninterrupted outbound operations, and the contract phasing plans as the basis of schedule and implementation.
7. Transfer all of the necessary construction material, conveyor equipment, tools, and components required for the implementation of the BHS to and from the designated Lay-Down areas during the work period and in conjunction with the Phased Implementation schedules. This may necessitate additional manpower due to the short duration of time available for implementation during any particular Phase and related BHS activity. All TSA and Airline operational areas associated with the BHS work shall be left broom clean at the end of the BHS Contractor's shift without any equipment, tools or components left in the area. BHS construction material, equipment and tools/components in existing operational areas shall be permitted in the immediate area of construction only during the BHS Contractor's work period/shift.
8. Provide all associated equipment and services necessary to accomplish the BHS Phases, which shall include, but not be limited to:

    a. Controls modification requirements during the interim conditions.
    b. Staging and storage requirements.
    c. Logistics needed for demolition and installation.
    d. Staffing and scheduling to complete the work during non-operational hours or within a single "shut down" period, i.e. no BHS Phase or related activity shall remain incomplete at the conclusion of the scheduled period. In the event that this shall occur, either the system shall be reverted to the original state or work around conditions shall be provided (at the expense of the BHS Contractor) to maintain operational continuity without degradation of service levels.
    e. Operational considerations to maintain continuity of service for the airlines as each Phase is implemented.

B. BHS Interim Conditions

1. The overall installation of the system shall also include BHS interim conditions, that shall include, but not be limited to, the following requirements to maintain the operation of unaffected BHS equipment and/or equipment that are in the process of getting tied-in for the final conditions:

    a. 180° Temporary Power Turn conveyor segment.
    b. Provision of temporary electrical connections, including conduits / wireway, wiring, junction boxes and pull boxes with related supports.

2. All required BHS interim conveyor equipment (i.e., mechanical, electrical and controls) and their

Copyright © 2018 by BNP Associates, Inc. (BNP)

associated supports / connections shall be included as part of the overall Project Phasing Plan and shall not be considered as an additional cost to the Owner. Provide the necessary manpower and equipment that shall be required for the interim conditions to minimize the system downtimes and inconvenience to the airlines and TSA operations; this work shall also include the manual handling of baggage for airline operations during the outage of their existing conveyor line(s).

3. Review and coordinate with the local TSA the availability of extra TSO's and ETD equipment as necessary to support the downtime (if any) of the existing Stand-alone EDS machines during the relocation/reconfiguration process and associated site acceptance testing.
4. Ensure prior to each phase appropriate staffing (porters) are provided for the manual handling of baggage to/from Ticket Counter input points, runout conveyors, TSA screening areas and baggage make-ups.

C. Project Phased Implementation Schedule

1. Adhere to the Project Construction (Phasing) Schedule, which appears in the Contract Documents. Strict attention shall be made to the phases and dates for this project. The Project shall coincide with other on-site project requirements. The Owner or their Representative shall coordinate project Phasing and may on occasion change the phase of work with proper notification. Therefore, the project schedule may be updated during the course of this project.
2. Fulfill duties in accordance with the latest project schedule, at no additional cost to the Owner. The BHS Contractor is responsible for the on-time completion of the total integrated BHS as specified in this specification section.
3. Prepare a detailed schedule of the subsystem phased work with associated drawings, on a subsystem or BHS Phase basis to delineate to the Owner or their Representative the planned work for the phase or subsystem and to coordinate all work with all concerned. This detailed schedule shall be submitted fourteen (14) days prior to actual work being performed. Work shall not commence without review approval of the schedule and associated drawings by the Owner or their Representative.

D. BHS Phased Implementation Summary

1. The BHS drawing package and this specification section define the general scope of work and sequence in which the work shall be performed. The tasks identify conveyors and subsystems, which are affected by the BHS Phases but are not intended to be all-inclusive.
2. Provide all associated equipment and services necessary to accomplish the BHS Phases, which shall include, but not limited to:

    a. Controls modification requirements.
    b. Staging and storage requirements.
    c. Logistics needed for demolition, modification and installation.
    d. Provision of MCPs to accomplish the specified work for the interim and final conditions.
    e. Provision of PLCs and associated networks to accomplish the specified work for the interim and final conditions.
    f. Staffing and scheduling to complete the work during non-operational hours or within a single "shut down" period, i.e. no BHS Phase or related Step shall remain incomplete at the conclusion of the scheduled period; BHS Contractor shall use multiple crews as necessary to accommodate the phased-in implementation that is described below within the respective areas of the facility. In the event that this shall occur, either the system shall be reverted to the original state or work around conditions shall be provided (at the expense of the BHS Contractor) to maintain operational continuity without degradation of service levels.
    g. Operational considerations to maintain continuity of service for the airlines as each Phase/Step are implemented.

3. The descriptions listed in the drawings and in the below referenced specification paragraphs are intended as an outline of work required for each Phase; detailed phasing of the overall BHS installation shall be coordinated with the Owner or their Representative through the shop drawing process. The BHS Contractor, at his own discretion, may perform the work in any sequential order but shall do so only to expedite the work for each Phase and minimize subsystem downtime. Coordinate the clearance for the BHS R.O.W.'s with the appropriate disciplines (i.e. M.E.P.) and

Copyright © 2018 by BNP Associates, Inc. (BNP)

assure that the R.O.W.'s are cleared prior to start of BHS work.

4. Reference the overall Program Phasing Plans (B-700 series) and the following outline. Include as part of the bid proposal the best duration period, per Activity within each Phase that will require completing the specified work.
5. Note: Prior to BHS work and EDS machine installation / relocations in Phase 4 and all subsequent phases where conveyor segments will be installed, all related BHS right-of-ways shall be cleared, and the area shall be prepared for the upcoming BHS conveyor subsystem(s) installations. All required EDS equipment (to be provided by the TSA) shall be coordinated/scheduled to be on-site and available for the specified changes and relocation by the TSA's Contractor. Additionally, the power supply drop to the BHS MCPs and EDS machines, including any/all data communication for the EDS machine computer equipment/workstations shall be provided at the designated location.
6. Note: The BHS Contractor shall ensure that all necessary conveyor equipment/components and/or temporary conveyor segments (e.g., slider bed, end pulleys, sections and the like) that are required for the conveyor tie-ins are on-site and available for the intended work, prior to proceeding with the respective phased-in implementation. Ensure that the appropriate Work Activity Bulletins have been submitted to the Airlines operating out of the Terminal through the Owner or their Representative, advising them of the upcoming works to take place with associated interim conditions and fallback plans. Additionally, all preparatory work such as conduit runs, wiring and the like are performed prior to the scheduled outages to minimize the operational downtimes of the respective conveyor subsystem.
7. Note: During the phased-in implementation, provide staffing/labor for certain operational conditions, as a fallback condition, should a tie-in be delayed, or should a failure be experienced that will inhibit the airline's operation for scheduled overnight tie-ins and operational turnovers
8. Phases 1 -3 Preparatory Work (not by Division 34)

    a. Construction of the new outbound baggage make-up area on Basement Level and new facility spaces on the Departures / Arrivals Level plus alterations to existing facility spaces.
    b. Adjust building layout (wall openings to be provided, utilities to be relocated).

9. Phase 4

    a. Install make-up device MU1, Oversize slide, MCPs and BHS conveyors, including interim 180° power turn connection, in the Basement Level and the Departures / Arrival Level.
    b. The TSA's Contractor will provide new CT80XL EDS machine pedestal and will install the new CT80XL EDS machine (EDS #3) with all associated screening equipment (computer equipment, inspection tables and the like) on the east side of the new make-up device.
    c. At the start of Phase 4, make-up staging and outbound baggage processing remains per existing Contract 1 conditions.
    d. At the completion of Phase 4, UA/DL will continue to process passengers via their existing ticket counters; however, their bags will be portered to the available new Ticket Counter Input Areas. DL/UA bags will be conveyed to the new make-up device for screening (via EDS #3) and baggage make-up, while AA bags will continue to be processed via the Contract 1 AA screening area (via EDS #1).

10. Phase 5

    a. Existing Contract 1 BHS Conveyors and associated MCPs demolished in Basement and Departures / Arrivals level (TE2, TE3, OE2).
    b. TSA’s Contractor relocates the existing UA/DL CT80DR EDS machine (EDS #2) with all associated screening equipment (pedestal, computer equipment, inspection tables and the like) to an interim location on the west side of the new make-up device.
    c. During Phase 5, UA/DL will continue to process passengers via their existing ticket counters; however, their bags will be portered to the available Ticket Counter Input Areas. DL/UA bags will be conveyed to the new make-up device for screening (via EDS #3) and baggage make-up while AA bags will continue to be processed via the Contract 1 AA screening area (via EDS #1).

11. Phase 6

    a. The remaining existing Contract 1 BHS conveyors will be demolished in the Basement and

Copyright © 2018 by BNP Associates, Inc. (BNP)

Departures / Arrivals Levels (TE1 and OE1).

b. BHS Conveyors installed in Basement level (TC1 and OT1).

c. During Phase 6, AA will continue to process passengers via their existing ticket counters; however, their bags will be portered to AA Ticket Counter Input Area (TC1). DL/UA will process passengers via their new ticket counters and their bags will be loaded to the UA/DL Ticket Counter Input Area (TC2). AA/DL/UA bags will be conveyed to the new make-up device for screening (via EDS #2 and EDS #3) and baggage make-up. Ensure prior to the scheduling of this Phase, American, Delta, United and the local TSA are notified that AA and DL/UA will have baggage screening and make-up for all bags at the new make-up.

d. When AA's final condition ticket counter desks are installed, bags from UA & DL Counters will be loaded at the UA/DL Ticket Counter Input Area (TC2) and bags from AA Counters will be loaded at the AA Ticket Counter Input Area (TC1).

12. Phase 7

a. BHS Conveyor installed in Basement level (OT1).

b. The TSA’s Contractor relocates the existing AA CT80XL EDS machine (EDS #1) with all associated screening equipment (pedestal, inspection tables, computer equipment and the like) to the Contract 2 location and relocates the Oversize screening area from Contract 1 location to Contract 2 location.

c. Once the AA CT80XL EDS machine (EDS #1) is relocated, install the required non-powered roller conveyors for the relocated existing AA CT80XL EDS machine.

13. Phase 8

a. The 180° power turn connection removed and the TC1 / OT1 outbound transport lines will be connected in an overnight cut-over.

b. Concurrently, the TSA’s Contractor relocates the CT80DR EDS machine (EDS #2) with all associated screening equipment (pedestal, inspection tables, computer equipment and the like) from the interim location on the west side of the new make-up device to the Contract 2 location.

1.) If the relocation of the CT80DR (EDS #2) cannot be completed in an overnight, bags awaiting screening on the OT1 line in excess of the capacity of the CT80XL (EDS #1) which was relocated in Phase 7 shall be portered from the new screening area to the CT80XL (EDS #3) located adjacent to the make-up device for baggage screening and loading onto the make-up device for baggage make-up.

c. Once the interim CT80DR EDS machine (EDS #2) is relocated, install the required non-powered roller conveyors for the relocated interim CT80DR EDS machine.

d. Baggage screening will take place at new screening area (via EDS #1 and EDS #2) and baggage make-up will take place at new make-up device.

e. The new CT80XL screening machine installed in Phase 4 (EDS #3) will be removed by the TSA's Contractor as coordinated with the TSA.

3.10 DEMOLITION/EQUIPMENT REMOVAL

A. Equipment Removal/Maintain Operations

1. Remove existing conveyor equipment indicated on the BHS Contract Drawings as "To Be Removed", including all associated support systems (e.g., hangers, threaded rods, header steel, angled support sills, sway bracing), conduits, junction/pull boxes, wiring, control stations, field control components, MCPs, impact protection and all other related items. All conveyor equipment and related components shall be removed with care, to enable the salvaging of components for the Owner’s spare parts inventory. Inform the Owner that the equipment has been removed and is available for review to determine what shall be salvaged and what shall be disposed; coordinate this process with the Owner or their Representative. Maintain operation of unaffected baggage handling equipment through the implementation of temporary electrical connections or the addition of supports to replace connections or supports removed in the demolition process.

2. If the removal of equipment creates unsecured access to a secured area, provide a guard on a 24-

Copyright © 2018 by BNP Associates, Inc. (BNP)

hour per day basis until installation of equipment returns the area to secured status.

B. Conduit Removal

1. Remove conduit including junction boxes and control/wiring devices rendered unused by the demolition process in its entirety to the motor control panel or power distribution panel as applicable. Exception: abandon in place the imbedded portion only of any imbedded conduit after removing all conductors. Where a conduit passes through a floor or wall cut the unused conduit flush with both surfaces of such floor or wall and abandon the section within the floor or wall if it cannot be removed without breaking masonry. Ensure that any area where material has been cut away is left in a clean and flush condition with no holes or protrusions showing. Where removal creates an indentation in concrete, chip away the surrounding concrete, cut the material (e.g., anchor bolts, conduit) below floor level and fill flush with cement.

C. Support Steel and Impact Protection Removal

1. Remove support steel including header beams and attachments rendered unused by the demolition process in their entirety. Remove all impact protection and associated attachments, anchors and the like that are rendered unused by the conveyor equipment demolition process in their entirety. Remove anchor bolts flush with floor, wall, or ceiling by burning or cutting.

D. Equipment/Control Device Reuse

1. Replace all electrical control stations/devices on equipment being installed or reconfigured on a long-term basis (i.e., Final Works) per the specified requirements.

3.11 DEMOLISHED MATERIALS TO BE DISPOSED

A. General

1. Remove and dispose all materials or items that are designated to be removed/demolished.

B. Equipment Disposal

1. Remove from Airport site all debris, rubbish and other materials resulting from demolition and alternation operations on a daily basis as they are removed. Transport and legally dispose equipment off-site in legal landfills or scrap yards. Obtain written permission from the property owner on whose property the removed materials shall be placed and submit a copy of the agreement to Owner or their Representative.
2. Burning of removed materials is not permitted on the project site.
3. Store materials, which cannot be removed daily in areas specified by Owner or their Representative.
4. Do not store or sell removed items on-site.

3.12 OPERATION AND MAINTENANCE TRAINING

A. General

1. Instruct and train the TSA's operating personnel, the Owner's operating and maintenance personnel at the work site. Separate training sessions, specific to each group, shall be provided for the Owner's BHS Operating and Maintenance personnel and the TSA's operating personnel. Conduct this training prior to Conditional Acceptance of the work and ensure competence in the operation and maintenance of the equipment and the system/subsystems.
2. Training is to be provided by a professionally qualified instructor. Use of site supervisors, equipment or system designers as an instructor for the formal training will not be accepted unless approved by the Owner or their Representative.
3. Furnish all tools, equipment, materials and supplies, and perform all functions and services required to complete the training as specified. With the exception of safety and overview training, training shall be divided into separate categories for operations training and maintenance training further

Copyright © 2018 by BNP Associates, Inc. (BNP)

broken down to specific trades.

4. No actual operations training of a piece of equipment will be permitted until the equipment is properly installed and is operational.
5. Training materials and documentation of the proposed training to be conducted shall be submitted to the Owner or their Representative for review and approval in accordance with the schedule of submissions prior to the testing of the system and scheduling of the first training session. The training program submittal shall include, at a minimum, the following information for review:

    a. Types and durations of training/classes.
    b. Name and professional credentials for each instructor/trainer.
    c. Max/min number of persons allowed per class.
    d. List of equipment that will be used/provided by the BHS Contractor for the training classes (e.g., Laptop, TV, White board or the like). Any specialty type of requirements such as classroom/conference room space, Laptop, TV, or white board (to shall be coordinated with the Owner; however, the Owner is not responsible to supply the above mentioned space or materials)
    e. Copies of all training materials, to be used during training. All training binders/materials shall be submitted for review in the format in which they will be used during the onsite training. It should be noted that the O&M manuals will not be allowed to be used for training purposes; however consolidated sections of the O&M manuals which have been tailored for classroom training are permitted.

6. Times and duration of the classes may involve irregular hours in order to provide training of the operational and maintenance personnel on different shifts.
7. All training sessions shall be monitored and approved by the Owner. Any session or portion thereof deemed unsatisfactory, based on evaluation of the training, shall be repeated by the BHS Contractor or the BHS Contractor's representative at no additional cost to the project.
8. Develop and maintain a training attendance record for all operation and maintenance training sessions presented. The record is to note the following information in duplicate form. The original copy of the record is to be forwarded to the Owner with the second copy being retained by the BHS Contractor for his files. The recorded training information must include for each session:

    a. Date of training session
    b. Name of project
    c. Name of Instructor
    d. Subject of training
    e. Time of training session
    f. Signature and department of each attendee

9. Provide the Owner with two (2) copies of the video recording of one (1) complete operational and maintenance training class for this project. The video recording shall be provided to the Owner in a media acceptable to the Owner, prior to beneficial use of the BHS and live baggage screening operations.

B. Operational Training

1. Provide formal instruction of the Owner's operational personnel and the TSA's operational personnel at the site who will be charged with operation of the BHS. Include a description and on-site demonstration of the electrical controls and their operation, modes of operation, the operating limitations of the equipment and the safety devices and their functions.
2. Minimum requirements for Operational Training shall include, but not be limited to, the following:

    a. Bag Placement on load conveyors.
    b. Tub usage and loading.
    c. Operating procedures for all BHS conveyance equipment.
    d. System Safety procedures, including lock-out and Tag-out requirements.
    e. Bag Jam Clearing procedures, as coordinated with the Airport's O&M group.

3. Provide a minimum of 20 hours of operational training per shift for this project, for a minimum of two (2) shifts.

Copyright © 2018 by BNP Associates, Inc. (BNP)

C. Maintenance Training

1. Provide formal training of the Terminal BHS maintenance personnel with the objective of preparing the employees to perform the required preventive maintenance to minimize breakdown and to perform necessary repairs when work stoppages or breakdowns of the equipment occur. The training shall include, but not limited to the following:

    a. Preventive and corrective maintenance procedures, including replacement of parts; lubrication quantities, types, frequencies and application points; and an estimate of the time to perform such procedures.
    b. Special tools, techniques, or procedures required for either preventative or corrective maintenance of the equipment, or it's auxiliary or support components.
    c. Procedures to perform adjustments required for alignment, wear and calibration for all preventative and corrective maintenance, and an estimate of time required to perform such procedures.
    d. Assembly and disassembly procedures, including parts lists required for appropriate and corrective maintenance. Models, "exploded" views, and audiovisual materials shall be used for training. These materials shall be handed to the Engineer upon completion of training. Hands on field training shall be provided, subject to the approval of the Owner.

2. The formal training shall consist of classroom and on the equipment training, as required to properly train personnel for each shift, prior to the start of operation. The training must cover all aspects of the electrical and mechanical equipment provided in this project. The electrical aspects shall include but not be limited to, electrical controls and control systems and PLC control systems.
3. On-site training shall be scheduled to commence immediately following classroom training and shall stress hands-on performance based application of the classroom training. Equipment shall be started, and relevant systems and components shall be demonstrated.
4. Provide maintenance training for any specialized equipment used in the related system that is not of the BHS Contractor's design or manufacture. The qualified representatives shall present such training, from the manufacturer of the specialized equipment.
5. Provide a minimum of 40 hours of maintenance training per shift for this project, for a minimum of two (2) shifts.
6. Examples of specialized equipment and other BHS maintenance related training include, but are not limited to those items listed below:

    a. Safety Procedures including Lock out/Tag-out
    b. Operation and Maintenance Manual use
    c. Warranty Procedures
    d. System Preventative Maintenance
    e. Jam Clearance Procedures
    f. Power Turns
    g. Slope Pallet Devices
    h. 45° Merge conveyor
    i. Fire/Security Doors
    j. Programmable Logic Controller Systems including basic ladder programming techniques
    k. Computer Systems Equipment
    l. Problem Resolution Screens
    m. Contingency Plans
    n. Configuration Management Plans and Procedures
    o. System Reports
    p. MCP Touch Screen Terminals and PC-type Computer Terminal Workstation, including development new reports, adding new conveyor subsystems with associated fault annunciation to the graphic/text display.

D. Supplemental Training

1. Should the Owner require supplemental training beyond that specified above, provide such training at a time and at rates as mutually agreed upon between the Owner and the BHS Contractor.

Copyright © 2018 by BNP Associates, Inc. (BNP)

- END OF PART 3 –

Copyright © 2018 by BNP Associates, Inc. (BNP)

PART 4 – CONTRACTOR QUALITY CONTROL REQUIREMENTS

4.1 FIELD QUALITY CONTROL

A. General

1. Coordinate the requirements of this section with Division 01 and 02.
2. During the construction and installation of the BHS, cooperate with other contractors who may be working in the immediate area for coordination of right-of-way clearances and verify as-built conditions.
3. Where walls immediately adjacent to conveyor equipment affect maintenance access, advise the Owner or their Representative of the location and size of the wall opening that needs to be developed to permit access to drive components, bearings, and other equipment that would normally be inaccessible because of the wall.
4. Ensure that the design and installation of all conveyor equipment provides maximum access for operational and maintenance personnel.

B. Quality Control Manual

1. Provide a Quality Control Manual acceptable to the Owner or their Representative.
2. Indicate inspection lists and methods that shall be utilized for quality control inspection and testing to confirm compliance with the specified requirements.
3. The Quality Control Manual shall assure that there is a system for final inspection and testing of completed products, construction and installation. Such testing shall provide a measure of the overall quality of the completed product and shall be performed so that it simulates product end use and function. Final inspection and testing shall provide for reporting to the Owner or their Representative any difficulties, deficiencies, or questionable conditions. When modifications, repairs, or replacements are required after final inspection or testing, there shall be re-inspection and re-testing of any characteristics affected.
4. The Quality Control Manual shall provide instructions for handling, storage, preservation, packaging, and shipping to protect the quality of products and prevent damage, loss, deterioration, degradation, or substitution of products. It shall also require and monitor the use of procedures to prevent handling damage to articles. Products in storage shall be protected against deterioration and damage.

C. Quality Assurance

1. The BHS Contractor shall be responsible for all quality control of its Work, including work performed by any of its subcontractors. It shall be the BHS Contractor's responsibility to include in its own direct subcontracts those provisions which are necessary to assure that the quality of subcontracted work will be as good as that required of the BHS Contractor by the requirements herein.
2. The Owner or their Representative shall have the right to audit and inspect the BHS Contractor's and its direct subcontractors' quality systems. Such audits may be conducted on a random or routine basis and may include an audit of the BHS Contractor's inspection and test records. The Owner or their Representative shall have the right to witness any tests or inspections and shall have access to all test data including test procedures, test specifications, and test results. The Owner or their Representative shall have the right to conduct independent tests or inspections at its own expense on any material or equipment to be used on the project. Should an independent test as directed by the Owner or their Representative result in failure, the BHS Contractor shall reimburse the Owner's expense for the test. The objective of all audits, inspections, or tests conducted by the Owner or their Representative is to ensure that all BHS Contractor-performed work is accomplished in compliance with the Contract Documents.
3. The Owner or their Representative shall have the right to reject, and the BHS Contractor shall replace at the BHS Contractor's cost, any construction, production or installation, or portion thereof, which has not been accomplished or documented as accomplished in accordance with the accepted Quality Control Plan.

Copyright © 2018 by BNP Associates, Inc. (BNP)

D. Quality Assurance Representative

1. Appoint a Quality Assurance Representative acceptable to the Owner or their Representative who shall be responsible for the overall quality assurance implementation and monitoring of the general requirements.
2. The quality assurance representative shall be available on-site during the construction period at all times and be qualified to advise the Owner or their Representative on the overall BHS scope of work (i.e., installation/removal procedures, provisioning, start-up and maintenance of the equipment).

E. Safety Program Manual

1. General

   a. Coordinate the requirements of this section with applicable sections in Division 01 as well as Division 02.

2. Prepare a site-specific safety program manual acceptable to the Owner or their Representative.
3. Designate a Safety Manager/Coordinator acceptable to the Owner or their Representative.
4. The Safety Program shall be implemented by the BHS Contractor to identify and resolve hazards. The Safety Program shall emphasize the prevention of accidents by resolving hazards in a systematic manner. The Safety Program Plan, as described below, shall identify the responsibilities of all parties for implementing the Safety Program.
5. The Safety Program shall demonstrate compliance with all applicable safety rules and regulations. The levels of compliance shall meet the OSHA Standards, ANSI Standards, NFPA Standards, NEC Standards, and trade association standards and recommendations as applicable.
6. The safety program manual shall contain as a minimum the following:

   a. Have as its objective to provide for the safety of the passengers, employees, general public and equipment.
   b. Encompass all elements within the BHS Contractor-provided BHS.
   c. Include all interfaces with Facility related systems and identify all hazards within the Facilities that may result from the unique characteristics of the BHS.
   d. Identify the safety roles and responsibilities of all the BHS Contractors' organizational elements and require accountability of each.
   e. Contain a hazard resolution process that includes the procedures necessary to identify and resolve hazards.
   f. Indicate safety inspection lists and methods that shall be utilized by all personnel employed on this project.
   g. A plan for furnishing and enforcing the use of individual protective equipment including hard hats, rain gear, protective footwear, protective clothing and gloves, eye protection, ear protection, respirators, safety belts, safety harnesses, safety lifelines and lanyards, and high visibility reflective safety vests.
   h. A plan for providing first aid facilities, supplies, and trained personnel.
   i. A plan for employee safety training to include employee safety orientation during the first week of work, weekly work crew safety meetings, periodic safety meetings for supervisory personnel, and special training prior to working with especially hazardous materials or operations.
   j. Emergency plans for items such as, but not limited to, fire emergencies, severe weather, earthquakes and other geologic hazards, or flooding emergencies, seriously injured personnel, traffic accidents along the project site, and injuries of members of the public.
   k. Pre-construction planning relative to safety and control of hazards including special tools, equipment, facilities, and individual protective gear.
   l. A plan for periodic safety inspections, investigations of all accidents and injuries and submission of timely reports.
   m. Submission of injury/accident/incident data for statistical analysis.

F. Project Management Office

1. Within one week of the date of commencement, initiate the Project Management Office, inform the Owner or their Representative of the details of the office, and authorize the Project Manager and

Copyright © 2018 by BNP Associates, Inc. (BNP)

on-site Field Superintendent to act as representatives.

2. The Project Manager shall be given full Owner to make decisions and enter into binding agreements with the Owner for all aspects of the project.
3. The BHS Contractor shall provide to the Construction/Program Manager, the Owner or their Representative a listing of all key project personnel with 24-hour contact details (cell phone number, pager number and e-mail addresses).
4. The BHS Contractor shall be responsible to supply all office equipment (e.g. telephones, copiers, fax, computers, plotters, furniture) required to establish their on-site project management office.

G. Work Activities Bulletin

1. Submit to the Owner or their Representative a detailed work plan for, individual subsystem testing and system outage for review/approval and coordination purposes with all concerned. A BHS specific "Work Activities Bulletin" must be submitted by the BHS Contractor to the Owner or their Representative for distribution by the Owner to other impacted contractors (e.g. EDS manufacturer, TSA's Contractor) a minimum of 14 days prior to the testing / system outage taking place.
2. No work should be commenced unless the BHS Contractor has a signed "Work Activities Bulletin" in hand and has distributed copies to the Owner or their Representative for distribution to other impacted contractors, the TSA, and the User Airlines.
3. The "Work Activities Bulletin" shall contain the following as a minimum, and shall comply with all applicable requirements of Division 01, Section 013516 (Alteration Project Procedures), regarding on-site coordination, phasing, and limitations on operations:

    a. BHS Contractor's internal deadlines for completion of pertinent facility interfaces by other disciplines (e.g. permanent system power, support structure, facility interface requirements and other similar responsibilities).
    b. Date and time planned activity to take place from start to finish
    c. User Airlines that are impacted
    d. Details of all conveyors to be removed with duration
    e. Details of all conveyors to be installed with duration
    f. Electrical installation duration
    g. BHS Contractor's internal testing with duration
    h. Ticket counter/make up device requirements for loading/unloading of test bags. Coordination with the Owner or their Representative and user airlines will be required
    i. Witnessed system testing with duration
    j. Full details of contingency plans including the following:

        1.) Duration of specific Fault condition required to implement contingency operations.
        2.) Notification process / organizations to be notified when contingency operations are to be implemented in response to a Fault condition.
        3.) Manual staffing / labor location and quantity of personnel required to manually transfer bags.
        4.) Movement path for bags.
        5.) Equipment such as hand carts or baggage carts & tug to move bags plus communication devices (walkie talkies / cell phones), if required.
        6.) Required actions by the Owner's Operations and Maintenance Group.
        7.) Required actions by the TSA or their Contractor such as changing staffing levels in baggage screening areas or installation/relocation of EDS equipment due to Fault / Construction conditions.
        8.) Required actions by User Airlines such as moving outbound loading operations to another available outbound subsystem due to Fault / Construction conditions.

    k. Details of person(s) (with qualifications) overseeing the activity
    l. Details and number of personnel to be present who are qualified to troubleshoot all aspects of their respective equipment during the planned activity, for example:

        1.) Mechanics
        2.) Electricians
        3.) Controls Engineers

Copyright © 2018 by BNP Associates, Inc. (BNP)

4.) Computer programmers

m. Other affected equipment manufacturers / Contractors (e.g. EDS manufacturer, TSA's Contractor). Confirmation that these manufacturers / Contractors have been notified and will be in attendance if required.

4. Detailed description of activities required when completing overnight changeovers to ensure that disruption to baggage handling system is kept to a minimum. Include all preparatory work by other trades. Provide back-up plan for recovery of operations if changeover work will not be completed in time.
5. Submit as part of the submittal process a sample of their proposed "Work Activities Bulletin" format for review and approval by the Owner or their Representative.

H. Field Quality Control Services

1. Establish and maintain quality control for operations under this Section to ensure compliance with Contract Document requirements and maintain records of quality control for alteration and removal operations.
2. Submit quality control procedures for operations in conjunction with work under this Section for approval. Do not start work prior to receiving approval.
3. The procedures shall include a checklist of points to be observed.
4. The actual quality control observations and inspections shall be documented, and a copy of the documentation maintained on file.
5. Any work found not to be in compliance with the Contract Documents, shall be promptly corrected in an approved manner, at no additional cost to the project.
6. If the facility is under construction or modification, cooperate with other contractors who may be working in the immediate area for coordination of right-of-way clearances and verify as-built conditions.
7. Where walls immediately adjacent to conveyor equipment affect maintenance access, advise the Owner or their Representative of the location and size of the wall opening that needs to be developed to permit access to drive components, bearings, and other equipment that would normally be inaccessible because of the wall.
8. Ensure that the design and installation of all conveyor equipment provides maximum access for operational and maintenance personnel.

I. Approval to Proceed

1. Before starting any work affecting baggage handling equipment that will temporarily discontinue or disrupt service to any other existing system/operations, notify the Owner or their Representative in compliance with Division 01, Section 013100, regarding on site coordination, limitations on operations and phasing, and obtain the Owner's approval in writing before proceeding with the work.

J. Preparatory Inspection

1. General

a. The inspection requirements of this specification are to be coordinated with Division 01.

2. To be conducted prior to commencing work:

a. Check schedules, project conditions, protection, traffic arrangements, utilities services maintenance, and related preparatory work for conformance to submittals.
b. Check to assure adequate protection against damage.
c. Ensure that all workers are qualified.
d. Review installation procedures to assure coordination of Contract Documents requirements with each person involved in performing the work.
e. Verify as-built conditions and notify the Owner or their Representative of conflicts.

K. Initial Inspection

Copyright © 2018 by BNP Associates, Inc. (BNP)

1. To be conducted after a representative sample of the work is complete:

    a. Review the representative sample of the work against the specification and code requirements previously discussed at preparatory inspection.
    b. Check for workmanship.
    c. Check the installation of each item for conformance.
    d. Check for damage and ensure that damaged work is corrected, at no additional cost to the project.
    e. Submit documentation for review to the Owner or their Representative detailing compliance of the above.

L. Follow-Up Inspection

1. Check completed work against results of initial inspection of representative sample of work against items mentioned in the preparatory inspection.
2. Verify that damaged work is corrected properly and approved by the Owner or their Representative, at no additional cost to the project.
3. Submit documentation for review to the Owner or their Representative detailing compliance of the above.

M. Inspection Results

1. Certify inspection results: This certification shall state that the observations were performed by or under the direct supervision of the BHS Contractors Quality Assurance Representative and that the results are representative of the conditions being certified.
2. Work accomplished shall be considered satisfactory only when the records and inspections show that all variances have been corrected and that the work is in conformance with the Contract Documents.
3. Submit documentation for review to the Owner or their Representative detailing compliance of the above.

4.2 INSPECTION/TESTING AND ACCEPTANCE

A. Inspection and Testing Procedures

1. General

    a. After installation of the Outbound BHS subsystem, the BHS Contractor shall demonstrate the system’s operating capability to the Owner or their Representatives. Accomplish prior to the start of the System's Acceptance Testing all “debugging” and internal testing. In addition, carry out a “dry test run” of Acceptance Tests prior to conducting such tests with the Owner or their Representative to ensure that tests conducted with the Owner or their Representative are successful. Make available to the Owner on a daily basis any and all records of internal testing and debugging (with corrective action carried out) performed prior to Acceptance Testing.
    b. The Owner or their Representative shall perform inspections and testing of the completed work. If any punch-list items are found, they shall be rectified prior to turning over the conveyor segments or proceeding to the subsequent testing phase.
    c. The System shall be capable of handling the maximum and minimum specified sizes and weights without jamming, damage or toppling of the baggage.

        1.) Provide all actual baggage and simulated weighted baggage required for testing. Actual baggage provided shall be representative of the many different types of baggage pieces encountered during live operations, including the maximum sizes and weights as defined in this specification. Simulated weighted baggage used shall be either weighted tubs or boxes. All baggage used for testing purposes shall be approved by the Owner or their representative prior to testing. The ratio of actual to simulated test baggage for this project shall be 50% of each. If necessary during the testing period, replace any simulated or actual test baggage that becomes damaged to

Copyright © 2018 by BNP Associates, Inc. (BNP)

the extent that it is no longer useable in order to maintain a minimum of test pieces at all times.

d. All tests shall be conducted with the above ratio of actual and simulated baggage except for load tests, which shall be acceptable to be performed with simulated baggage only. No sand, dirt, or other abrasive material shall be used for weight while performing load tests.

e. Provide all labor for the specified BHS acceptance inspections and tests, and all required commissioning to demonstrate the systems acceptance to the Owner. The labor / staffing for the BHS acceptance inspections and tests shall include, but not be limited to manual handling of the test bags and appropriate service personnel "on-site" during the testing period to service or adjust, as required, the System equipment as well as to open all control boxes, control station covers, drive assembly safety guards, and covers for the Owner inspection of the system equipment.

f. Provide all necessary test, measuring, and recording devices required to demonstrate the operational characteristics and performance of the equipment to the satisfaction of the Owner (clamp-on type ammeter, direct read FPM digital readout tachometer, and all other required devices).

g. The BHS Contractor, prior to the start of the System's Acceptance Testing shall accomplish all "debugging" and internal testing. In addition, carry out a "dry test run" of all Acceptance Tests prior to conducting such tests with the Owner and their representatives, to ensure that tests conducted with the Owner and their representatives are successful. The BHS Contractor shall submit to the Owner or their Representative on daily basis any and all records of internal testing and debugging (with corrective action) performed prior to Acceptance Testing.

h. Upon completion of the Outbound BHS installation, all related programming and internal testing/debugging, the BHS Contractor shall demonstrate the system's operating capability to the Owner or their Representative for acceptance, to confirm compliance with the specified requirements as contained in this document as well as all appendices. Provide written notice (minimum 14 days) to the Owner prior to acceptance testing that they have completed all "dry test runs" of the acceptance tests and are ready for the witnessed testing. Ensure that the Owner or their Representative witness all Acceptance Tests and shall indicate Acceptance by signing and dating the test data sheet. The Owner reserves the rights to back charge the BHS Contractor for the time and expenses of all who attended the Acceptance Testing on the Owner's behalf should the requested acceptance test(s) be unsuccessful and require re-testing at a later date. The system acceptance test demonstrations shall be carried out per the following documentation and related tests:

1.) The BHS Test Plans that shall be prepared by the BHS Contractor in compliance with the specified requirements of Part 4, Section 4.2 (Inspections/Testing and Acceptance).

2.) Local Acceptance Testing - All of the BHS Contractor's testing (and retesting of failed tests) shall be carried out by the BHS Contractor, and witnessed by the Owner, and their representatives, using the approved test plans – per Part 4, Section 4.2 (Inspections/Testing and Acceptance) of this specification to certify that the BHS satisfactorily passed per the pass/fail requirements of the test plans and is ready for beneficial use.

2. System Inspection and Test Plan Submittal

a. Submit an Inspection and Test Plan for this Project based on the information provided below and submitted per the submittal schedule detailed Part 1 of this specification for review and approval by the Owner or their Representative.

b. The BHS Contractor is to be aware that various subsystems may require testing independent of one another. Therefore, a number of tests will have to be conducted at the various stages of installation.

c. The test plan shall be submitted in both hard copies for field use during the testing process and a completed (based upon acceptance testing) electronic format agreed upon by the Owner or their Representative.

d. The test plan shall include as a minimum the following:

Copyright © 2018 by BNP Associates, Inc. (BNP)

1.) Description of each Test.
2.) Pass/Fail Criteria.
3.) Expected duration of the test.
4.) Number of test bags required and where they are to be positioned for the start of the test.
5.) If required, confirm all bag statistics on the MCP Touchscreen Terminals / PC-type Computer Terminal Workstation reports have been reset.
6.) List all test equipment required.
7.) Number of personnel required for the test to include:

a.) Test Supervisor.
b.) Mechanical.
c.) Electrical.
d.) Controls/computer engineer(s).
e.) Personnel required to load and remove bags.

8.) List other affected equipment manufacturers (e.g. Access Control, Fire Alarm) that may be required for the test. Confirmation that these manufacturers have been notified and will be in attendance.
9.) Details of all reports to be printed after the test.
10.) Pass/Fail and Notes/Comments sections.
11.) Section for witnessed sign off, to include as a minimum the BHS Contractor, the Owner or their Representative

e. Prepare an Inspection and Test Plan for this Project based on the information provided below and submitted per the submittal schedule detailed in Part 1 of this specification for review and approval by the Owner or their Representative.

f. The Owner's or their representative's inspections and tests shall include the following checklist. This list is included as a reference for the BHS Contractor, so that he may perform his own quality assurance/control program. The following is intended to be a guideline, and is not to be construed as all-inclusive:

1.) Mechanical Static Inspection: Submit a comprehensive, easy to read mechanical equipment inspection plan for every piece of mechanical equipment installed as part of the BHS. This inspection plan shall verify adherence to the Specification for the following items:

a.) Belt Conveyors: Gaps between adjacent head and tail pulleys, - Vertical clearance, - Angle of incline/decline, 4" conveyor I.D. - Gaps between adjacent bed sections, - Gaps between adjacent side guard sections, - Baggage snag points, - Sharp edges or shear burrs, - Condition of painted surfaces, - Tightness of all hardware, - Alignment of stainless steel trim and bed section filler plate, - Spacing of vertical braces for side guards/back guards, - Spacing of conveyor supports, - Sway bracing, - Trim securement screw type and countersinking, - Safety guarding/belly pans, - Anchoring/mounting of access ladders, - Belting material and splicing, - Belt lacing size and cable, - 1" V-notch in belting splice, - Belt path routing, - Belt wrap, - Belt tension, - Pulley diameter, - Pulley shaft diameter, - Vertical alignment of head and tail pulleys, - Lateral position of pulleys, - Return roller diameter, - Return roller spacing, - Bearing mounting lock washers, - Bearing jacking bolts, - Bearing grease zerk removal, - Bearing caps, - Motor and speed reducer mounting lock washers, - Speed reducer drip pan, - Motor/speed reducer related sprocket/sheave and shaft alignment, - Motor/speed reducer related sprocket or sheave key tightness, - Motor/speed reducer related chain/V-belt tension, - Chain/V-belt safety guard, - Speed reducer leakage, - Speed reducer lubrication level, - Mounting of speed reducer torque arm, - Safety finger guards on end pulleys at staffed conveyors (ticket counter conveyors and at TSA screening area), – End safety guard at runout conveyor, – conveyor shrouding on conveyors in TSA screening area, -- 25% take-up pulley

Copyright © 2018 by BNP Associates, Inc. (BNP)

position, - Installation of strip door type draft curtain, - Installation of fire/security doors, - Removal of construction related debris, - Maintenance access, - Protective guard railing installation, - Vertical clearance for traffic aisles.

b.) Incline Plate/Slope Pallet Devices: Vertical clearance above plates/pallets, - Gaps between adjacent back guard sections, - Gap between perimeter finger guard and top of pallet not in excess of 1/8", - Skirting above and below device conveying surface, - Sharp edges or shear burrs, - Condition of painted surfaces, - Tightness of all hardware, - Trim securement screw type and countersinking, - Baggage snag points, - Drive assembly safety guarding, - Speed reducer drip pan, - Motor/speed reducer type and alignment, - Motor-driven sprockets/sheaves alignment, - Motor-driven chain/V-belt tension, - Speed reducer oil leakage, - Removal of construction debris, - Maintenance access, - Protective guard railing, - Pallet-driving sprocket alignment, - Pallet-driving chain tightness.

c.) Motor Control Panels: I.D. information for MCP and all devices contained within -- control station I.D./function tags -- illuminated push button switch protective guard ring -- location of control devices -- tightness of all hardware -- control circuit wiring size, type, color, and number tag -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- plastic wire raceway -- splices in plastic wire raceway -- plastic wire raceway covers -- conduit routing and mounting -- tightness of conduit fittings -- conduit bushings and chase nipples -- "air-space" around programmable logic controllers -- MCP door(s) mechanical safety interlock -- safety shield over line and load terminals of MCP main breaker -- orientation of status panel -- restraint clips for plug-in type power supply -- MCP Control Station I.D. tag.

2.) Electrical Static Inspection: Submit a comprehensive, easy to read electrical equipment inspection plan. For the determination of terminal tightness, all terminals in motor control panels or field mounted devices shall be tightened to the manufacturer’s recommended torque specifications utilizing a certified calibrated torque wrench or appropriate tool. The BHS Contractor shall be required to demonstrate to the Owner or their Representative that the screws are set at the proper torque value and the BHS Contractor shall include this information in the below referenced electrical static inspection reports. This inspection plan shall verify adherence to the Specification for the following items:

a.) Belt Conveyors: Control station I.D./function tags -- control station and disconnect switch accessibility/location -- illuminated pushbutton switch protective guard ring -- tightness of all hardware -- photocell mounting -- control circuit wiring size, type, color, and number tag -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- splice point wire nuts within junction boxes -- conduit routing and mounting -- tightness of conduit/sealtite fittings -- junction box covers -- unused openings in junction boxes or control device boxes -- safety disconnect switch lockout capability -- lanyard cable supports and limit switch -- maintenance access -- record motor name plate data, size of motor overload heaters, and size of all fuses.

b.) Incline Plate/Slope Pallet Devices: Control station and disconnect switch accessibility/location -- control station I.D./function tags -- illuminated pushbutton switch protective guard ring -- tightness of all hardware -- photocell mounting -- control circuit wiring size, type, color, and number tag -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- splice point wire nuts within junction boxes -- conduit routing and mounting -- tightness of conduit/sealtite fittings -- junction box covers -- unused openings in junction

Copyright © 2018 by BNP Associates, Inc. (BNP)

boxes or control device boxes -- safety disconnect switch lockout capability -- maintenance access -- record motor name plate data, size of motor overload heaters, and size of all fuses.

c.) Motor Control Panels: I.D. information for MCP and all devices contained within -- control station I.D./function tags -- illuminated push button switch protective guard ring -- location of control devices -- tightness of all hardware -- control circuit wiring size, type, color, and number tag -- power circuit wiring size, type, color, and number tag -- wire "whiskers" at terminal points -- wiring terminal point screw tightness -- plastic wire raceway -- splices in plastic wire raceway -- plastic wire raceway covers -- conduit routing and mounting -- tightness of conduit fittings -- conduit bushings and chase nipples -- "air-space" around programmable logic controllers -- MCP door(s) mechanical safety interlock -- safety shield over line and load terminals of MCP main breaker -- orientation of status panel -- restraint clips for plug-in type power supply – MCP Control Station I.D. tag.

3.) Dynamic Mechanical Testing: Submit a comprehensive, easy to read mechanical test plan. This test plan, at a minimum, shall verify the specified functionality of the following:

a.) Belt Conveyors: Conveyor speed -- belt tracking -- shaft run-out on pulleys -- excessive vibration -- operation of clutch/brake units (or VFD units, as applicable) -- lateral movement of speed reducer on shaft during start/stops -- abnormal noises -- torsion flexing of drive assembly during start/stop operation -- operation of controls.

b.) Incline Plate/Slope Pallet Devices: Operation of “soft-start” device -- engagement of plate cam followers with drive assembly -- vertical or horizontal displacement of plates through drive assembly section -- excessive vibration -- abnormal noises -- binding of perimeter finger guards with top surfaces of plates -- operation of controls.

4.) Dynamic Electrical Testing: Submit a comprehensive, easy to read electrical test plan that clearly identifies all installed control devices, the control device locations in the BHS, the function of the control device, all conveyors affected by the control device, and the expected field result with applicable system monitor message/display. The test plan shall be submitted in both hard copy for field use during the testing process and a completed (based upon acceptance testing) electronic format agreed upon by the Owner or their Representative.

a.) All Control Devices: Photocells -- limit switches -- status lights -- start-up alarms -- fault warning alarms -- fault warning alarms with multiple faults -- fault warning alarm silence buttons -- timer settings -- auto shut-down -- motor overloads -- motor disconnects – auto start – cascade operation – inch and feed operation – e stop function – run lanyard – over-height/over-length function – jam function.

b.) MCP Touchscreen Terminals / PC-type Computer Terminal Workstation: Graphical system status display – graphic fault warning and associated text display -- report generation (daily, weekly, monthly, annual and on demand) – accuracy of all reports -- problem resolution text – system re-route/re-configuration – access to all security levels –ability to render individual equipment unavailable/available – statistics and counter reset capability – demonstrate statistical data backup functionality.

c.) Cable Testing: Test all cables, including all fiber optic, Cat-5e and Cat-6 telecommunication cables, and all cables to be connected as part of an interface to another system (e.g. fire system, Access Control System, PC-type Computer Terminal Workstation).

d.) Interface Testing: Test all interfaces with other systems (e.g. fire system, Access Control System). Coordinate with other trades in support of this

Copyright © 2018 by BNP Associates, Inc. (BNP)

testing.

5.) Empirical Readings

a.) The Empirical Readings which are to be taken at the time of Conditional Acceptance Testing are to include the following:

(1.) Main Feeds: Fuse size per phase, actual amperage per phase.
(2.) Transformers: Fuse size per phase, actual amperage per phase.
(3.) Conveyor/Device Speeds: Actual "center-line" speed of conveyor/device.
(4.) Motors: Nameplate data, horsepower, listed motor current; fuse size per phase, actual amperage per phase, overload heater size or designation.
(5.) VFDs: record all VFD settings, if applicable.

6.) Rate Testing: Submit a comprehensive, easy to read test plan detailing the loads, system loading points, manpower required throughout the BHS for loading and re-circulating testing materials (if applicable), observational manpower required to monitor the system performance during the test, and clearly identify the system reports (by name) that will be used to demonstrate the system has achieved the specified processing rates.

a.) The Rate Test shall require the demonstration of the ability to accurately process the specified items per minute for 30 consecutive minutes. In order to perform the 30-minute Rate Test for a 30 bag-per-minute subsystem, a minimum of 900 real and simulated bags would be required.
b.) It is the intent of the Specifications that the maximum processing rate is for average length bags of 28-inch length.

7.) Load Testing: Submit a comprehensive, easy to read test plan listing the expected load rating for each device, at a minimum, provide the following:

a.) Individual device identifications with the expected load rating for each device.
b.) Amperage readings per phase under No Load conditions.
c.) Fuse Sizes (if applicable) and motor heater settings.
d.) Motor nameplate FLA for each device drive and HP.
e.) Amperage readings per phase under Full Load conditions.
f.) Pass/Fail and Notes/Comments sections.

(1.) All FLA readings taken during load testing shall be recorded and included in the Final O&M Manual for record. Motor FLA shall be measured with full load during load tests and any motor that draws more than the name plate FLA (after start up in rush current has flattened) shall be replaced with a motor of appropriate size that shall result in no more than the max name plate FLA during load test.

8.) Redundancy Testing: Submit a comprehensive, easy to read test plan, which shall demonstrate the redundancy capability of the system:

a.) At a minimum, the test(s) shall verify the ability of the System to perform the following:

(1.) Redundancy Operation of the make-up device

9.) Operational, Functional and System Performance Testing

a.) The Operational, Functional and system performance tests shall verify the installed control devices as described in the Baggage Handling System Description of Operations, which shall be submitted as part of the project shop drawing submittal process, and that all the control functions required by the specification are provided. Additionally, the system performance tests shall verify the compliance of the installed BHS with the specified requirements of

Copyright © 2018 by BNP Associates, Inc. (BNP)

the contract documents. The acceptance inspections and tests for the overall system shall include the applicable items outlined in this Specification Section 347739 and the controls functionality of the BHS.

b.) These tests shall demonstrate the subsystem's compliance with the specified controls requirements of the contract documents. Tests on controls functionality shall include, but not be limited to, manual start/stop controls, bag over-height/over-length detection and reset controls, emergency stop and reset controls, jam detection and reset functionality, cascade stop controls, overload simulation, auto start/stop functions, , auto-configuration capabilities, BHS Computer functionality and related reporting functions, and BHS

c.) At a minimum, the tests shall verify the ability of the System to perform the following, which shall also include confirmation of the installed computer systems:

(1.) PLC Communications between the BHS.
(2.) All Operational and Maintenance Computer generated reports for accuracy and content.

10.) Test Failure

a.) A failure during any test period shall be defined as any design characteristic or malfunction of the furnished equipment or materials that damages product or reduces any operating rate below those "specified".

b.) Conditions resulting from improper loading of product or loading product of sizes not included in specification requirements will not be considered as failures.

B. Conditional Acceptance

1. Conditional Acceptance will only be considered after the following are completed:

a. The Conditional Acceptance Inspection and Testing procedures presented above are successfully completed as specified.
b. Final Operation and maintenance manuals have been delivered.
c. Operation and maintenance training has been completed.
d. Spare parts as purchased by the Owner have been delivered.
e. All special tools and equipment required for maintenance purchased by the Owner have been delivered.
f. The name, address and a 24-hour phone number of a representative who has the Owner and experience to make immediate replacements and repairs for the full life of all warranties has been provided.

2. Conditional Acceptance Inspection and Testing

a. The System, including all upper and lower level controls, shall demonstrate compliance with the approved Test Plan. The individual inspections and tests shall be performed in the order presented above. System deficiencies (punch list items) shall be corrected before performing the subsequent inspections or tests. The overall system inspections and tests for the complete BHS shall include the following minimum requirements. The Owner at their discretion may request for reimbursement of costs from the BHS Contractor for multiple re-inspections of system deficiencies/punch list items.

1.) Mechanical Static Inspection
2.) Electrical Static Inspection
3.) Dynamic Electrical Testing
4.) Dynamic Mechanical Testing
5.) Empirical Readings
6.) Load Testing
7.) Rate Testing
8.) Functional Controls Testing

Copyright © 2018 by BNP Associates, Inc. (BNP)

9.) Redundancy Testing

3. Upon successful completion of the specified Inspections and Testing, the Owner shall issue a written notice of Conditional Acceptance.
4. A Conditional Acceptance status shall indicate that the Owner or their Representative have approved the equipment as worthy for operational use.
5. The Conditional Acceptance shall not relieve the responsibility for maintenance, security and insurance on the system.
6. In no case will Conditional Acceptance relieve the responsibility for performing all the work set forth in the Contract Documents.
7. At the time of Conditional Acceptance, the amount of retention held until issuance of a Certificate of Final Acceptance shall be a summation of 10% of the total value of the project and the assessed value of open punch list items (to be determined by the Owner).
8. Conditional Acceptance Operational Period

    a. Upon issuance of a Certificate of Conditional Acceptance, a one (1) month Operational Period shall commence in which the Owner shall put all systems into on-line operations processing the daily flow of baggage.
    b. During this one (1) month Operational Period, provide full-time technical site representation during the actual hours of operation with a minimum of 16 hours per day, 7 days per week. Ensure that the representatives shall be capable and duly qualified to provide service for any problems, which occur during this period. At a minimum, provide one qualified personnel per shift to trouble shoot and immediately resolve any problems, which may arise. The BHS Contractor's on site personnel shall be capable of trouble-shooting and resolving all electrical and controls related issues.
    c. Should any downtime occur during these hours due to major faults in the BHS (i.e., PLC fault, motor overloads, motor faults, or any other faults deemed major by the Owner) the BHS Contractor will be responsible for immediate rectification and assisting the Owner in any way so that Operations is not impacted in any way.
    d. During the one (1) month Operational Period, keep a detailed computer log, as detailed in the Submittal Requirements of this specification.
    e. If, at the Owner's discretion, site representation is deemed unnecessary, it shall be discontinued and the Owner shall receive a prorated credit.
    f. If a problem occurs within the BHS, and the Owner has elected to not require full-time technical site representation during the one (1) month Operation Period, the BHS Contractor shall supply the name(s), address(s) and a 24-hour phone number of representative(s) that can be contacted who have the Owner and experience to make immediate recommendations and assist the Owner or the Owner's Maintenance Contractor to return the system to a fully on-line state in the shortest possible time frame.

C. Conditional Acceptance With Defects

1. If the System is found to be unacceptable at the time of Conditional Acceptance Inspection and Testing, the Owner shall issue a written "Defects List" report containing information about the particular defects that must be remedied before Final Acceptance will be granted. At this time, if the defects do not affect the functionality of the System, the Owner may elect to advise in writing that "Conditional Acceptance with Defects" has been granted. All terms presented in the "Conditional Acceptance" portion of this Specification shall apply.
2. A "Conditional Acceptance with Defects" status, if issued, shall indicate that the Owner has approved the equipment as worthy for operational use. Subsequent to "Conditional Acceptance with Defects" issuance, the one (1) month Operational Period shall commence in which the Owner will put the System into on-line operations processing the daily flow of baggage. The Owner shall maintain the right to judge whether any hazard may exist to personnel or equipment due to unacceptable inspection results and revoke this approval. In the event the approval is revoked, the one (1) month Operational Period shall be suspended until the hazard is remedied.
3. The Owner shall be entitled to retain from the project payments an amount commensurate with the value of work remaining to be accomplished. Further, all outstanding work must be performed at times during periods convenient to the Owner and to the requirements of a fully operating system.

Copyright © 2018 by BNP Associates, Inc. (BNP)

4. The BHS Contractor must notify the Owner within the one (1) month Operational Period that all outstanding items on the "Defects List" have been corrected and that Inspection and Testing may continue. When all items have been approved in accordance with the Specifications, this shall conclude Inspection and Testing of the BHS. Only the remaining time of the one (1) month Operational Period shall be required prior to application of the Final Acceptance conditions.

D. Delayed Conditional Acceptance With Defects List

1. If the System is found to be functionally unacceptable at the time of Conditional Acceptance Inspection and Testing, the Owner shall issue a written "Defects List" report containing information about the particular defects that must be remedied before the one (1) month Operational Period will begin.
2. Items appearing on the "Defects List" shall be considered incomplete, defective or not in conformance with the Specifications. The failure to include certain items does not alter the responsibility to complete the System in accordance with the Contract Documents.
3. A maximum period of 15 days will be allowed to correct the outstanding items on the "Defects List".
4. After all the items on the "Defects List" have been corrected, notify the Owner or their Representative that the System is ready for continuing Conditional Acceptance Inspection and Testing.
5. Upon completion of "Conditional Acceptance Inspection and Testing", the terms presented in the "Conditional Acceptance" or "Conditional Acceptance With Defects List" portions of this Specification shall apply, as appropriate.

E. Final Acceptance

1. Final Acceptance shall only be considered when completion of the Conditional Acceptance terms, successful completion of the one (1) month Operational Period, and the following criteria is met:

    a. The System has not experienced repeated repairs and adjustments and is achieving the specified rate, accuracy and availability standards as required by this Specification.
    b. The System has successfully completed the specified Inspections and Testing, with no outstanding punch list items.
    c. The System is in full compliance with the Contract Documents.
    d. The Owner and all other governing agencies have made their inspections and given their approvals.
    e. Certificates of Installation Compliance have been issued to the Owner (e.g. weigh scale certifications)
    f. Warranties for all materials and equipment received from Subcontractors and Suppliers have been assigned to the Owner.
    g. A spare parts and tools audit has been conducted and all tools have been turned over to the Owner. All spare parts purchased by the Owner have been delivered.
    h. The PLC and source codes for all programs in the BHS Computer System have been provided to the Owner
    i. Accurate "As-built" drawings and all manuals as specified in this Specification have been delivered.
    j. Operation and maintenance training have been completed.

- END OF PART 4 -

Copyright © 2018 by BNP Associates, Inc. (BNP)

TABLE OF CONTENTS

SECTION DESCRIPTION PAGE

PART 1 - GENERAL 1

1.1 RELATED DOCUMENTS 1
A. General 1
B. Drawings 1
C. Existing Equipment Drawings. 1
D. Project Related Documents 1

1.2 SUMMARY 2
A. General 2
B. Scope of Work 2
C. BHS General Requirements 5
D. New Outbound BHS Requirements 6
E. Existing Baggage Handling System (BHS) Designated for Removal/Disposal 6
F. Motor Control Panels and Programmable Logic Controllers (MCP/PLCs) 6
G. Baggage Handling System PC-Type Computer Terminal Workstation 7
H. BHS Interface Requirements 7
I. BHS Allowances 7
J. BHS Bid Alternate 7
K. Project Phased Implementation Schedule 7
L. Interim BHS Conditions Manual Handling of Baggage 8

1.3 DEFINITIONS 8
A. Acronyms and Abbreviations 8
B. Authorized Representative 10
C. General 10

1.4 BHS EQUIPMENT IDENTIFICATION 12
A. General 12
B. Equipment Identification 12

1.5 SUBMITTALS 12
A. General 12
B. BHS Contractor Documents Submitted for Review 12
C. Submittal Deadlines 12
D. Detailed Master Schedule 14
E. Detailed BHS Phasing Plans 16
F. Structural Attachment Details 16
G. Shop Drawings, Installation Drawings, and As-Built Documents 16
H. Catalog Cuts and Equipment Specifications 21
I. Operation and Maintenance Manuals 21
J. Periodic Maintenance Inspection and Lubrication Chart 29
K. Training Program 29
L. Environmental Requirements 29
M. List of Lubricants 29
N. Inspection, Functional Specification and Testing Program 29
O. Test Reports 30
P. Certification of Installation Compliance 30
Q. Certification of Test Compliance 30
R. Final Parts List 30
S. System Power Requirements and MCP Sizes / Locations 30
T. System Reliability Calculations 30
U. Bi-Weekly Status Reports 31
V. Submittal Register/Log 31

Copyright © 2018 by BNP Associates, Inc. (BNP)

W. System Installation, Construction and Commissioning Safety Program Manual 31
X. Computer/Software/Hardware Inventory 31
Y. Computer Log 32
Z. Project Management Team and Staffing Plan 32

1.6 BHS CONTRACTOR'S QUALITY ASSURANCE GENERAL REQUIREMENTS 32
A. General 33
B. Laws, Codes, Rules and Regulations 33
C. BHS Contractor Qualifications 33
D. BHS Project Configuration Management Plan 33
E. Non-Standard Equipment 34
F. Pre-Installation Meeting 34
G. Pre-Demolition Meeting 35

1.7 PROJECT CONDITIONS 35
A. General 35
B. Installation Conditions 35
C. BHS Phased Implementation 36
D. Ramp Area Proximity 36
E. Lay-down Area Restrictions 36
F. Restoration of Service Costs 36
G. BHS Rights-of-Way 36

1.8 PROTECTION OF THE WORK 36
A. General 36

1.9 SYSTEM DESIGN AND PERFORMANCE REQUIREMENTS 37
A. General 37
B. Material and Equipment Approvals 37
C. Request for Deviations from Drawings or Specifications 37
D. Baggage Conveyors 38
E. System Throughput Processing Rates 39
F. Baggage Characteristics 39
G. Physical Constraints 40
H. Vibration 40
I. Balancing 40
J. Service Conditions 41
K. System Safety 41
L. Personnel Safety 41
M. Noise Levels 42
N. Radio Frequency Interference/ Electro Magnetic Interference (RFI/EMI) 43
O. Maintainability, Life & Reliability 43
P. Standard/Interchangeable Components 44
Q. Lifespan 44
R. System Reliability 44
S. Parts Availability 45

1.10 STANDARDS AND CONSTRUCTION CODES 45
A. General 45
B. Construction Codes 45

1.11 WARRANTIES 46
A. General Warranty 46
B. Warranty Exclusion 47
C. Warranty Limitation 47
D. Technical Support 47
E. Royalties and License Fees 47
F. Labor Warranty 47
G. Parts Warranty 47
H. Design Warranty 48

Copyright © 2018 by BNP Associates, Inc. (BNP)

PART 2 – PRODUCTS 50

2.1 ACCEPTABLE MANUFACTURERS 50
A. BHS Contractors and Integrators for the BHS of the Terminal Renovations and Expansion Outbound Baggage Handling System Program 50
B. BHS Equipment Suppliers 50
C. BHS Controls Subcontractors 50
D. BHS Equipment 50

2.2 MATERIALS 54
A. General 54
B. Material 54

2.3 FABRICATION 54
A. General 54

2.4 BELT CONVEYORS 55
A. Belting 55
B. Belt Splicing 55
C. Pulleys 56
D. Drive Assemblies 60
E. Flexible Couplings 63
F. Intermediate Sections 63
G. Floor Supports 63
H. Overhead Supports 63
I. Safety Guards 64
J. Side Guards 65
K. Break-Overs 66
L. Bearings 66
M. Hardware 67
N. Straight Belt Conveyor 67
O. Ticket Counter Take-Away Conveyors 67
P. Checked Baggage Screening Area Load and Unload Conveyors 67
Q. Power Turns 67
R. Spiral Turns 68
S. Queue Conveyors 68
T. 45° Merge Conveyors 69

2.5 INCLINE PLATE/SLOPE PALLET MAKE-UP DEVICE 69
A. General 69
B. Dimensions 69
C. Load Rating 69
D. Operating Speeds 69
E. Drives 69
F. Pallet/Flight Assemblies 70
G. Frame and Track 70
H. Finish and Trim 71

2.6 RELOCATION OF EXPLOSIVE DETECTION SYSTEMS – REVEAL CT80DR AND CT80XL 72
A. TSA Equipment Responsibility 72
B. BHS Contractor Responsibility 72

2.7 MISCELLANEOUS MECHANICAL EQUIPMENT 72
A. Catwalks 72
B. Crossovers 73
C. Toeboards 74
D. Handrails 74
E. Maintenance Ladders 74
F. Fire Door (Powered) 76
G. Security Door (Powered) 77

Copyright © 2018 by BNP Associates, Inc. (BNP)

H. Non-Powered Portable Gravity Roller Bed Conveyors....78
I. Draft Curtains....78
J. Conveyor Impact Protection....78
K. Slides....79

2.8 SPECIAL MECHANICAL EQUIPMENT REQUIREMENTS....79
A. General....79
B. Baggage Over-height Restriction Bars....79

2.9 ELECTRICAL TECHNICAL REQUIREMENTS....79
A. Electrical Service to be Provided by the BHS Contractor....79
B. Power Source....80
C. Raceways....81
D. Wire and Cable....82
E. Grounding....84
F. Support....84
G. Boxes....84

2.10 ELECTRICAL COMPONENTS....84
A. Wiring Devices....84
B. Control Devices/Stations....84
C. Electrical Device Identification....92

2.11 MOTOR CONTROL PANELS (MCP)....94
A. General....94
B. Installation Requirements....96
C. Panel Identification....96
D. Shop Drawings....97
E. Utility Outlet....97
F. Lighting....97
G. Control Devices....97
H. System Status....98

2.12 BHS PC-TYPE COMPUTER TERMINAL WORKSTATION....100
A. General Design Requirements....100
B. Building Fire Alarm System....103
C. Programmable Logic Controller (PLC) Functional Description....103
D. Software Design Requirements....104
E. Software Confidentiality....105
F. Source Code....105

PART 3 - EXECUTION....106

3.1 PREPARATION....106
A. General....106

3.2 WORKMANSHIP....106
A. General....106

3.3 FABRICATION & INSTALLATION SPECIAL CONSIDERATIONS....107
A. General....107

3.4 DELIVERY, STORAGE, HANDLING AND ON-SITE RESPONSIBILITIES....107
A. Delivery, Storage, Handling....107
B. On-Site responsibilities....107

3.5 INSTALLATION....109
A. General....109
B. Tolerances....109
C. Side Guards....110
D. Belt Splicing/Lacing....110
E. Belting....110

Copyright © 2018 by BNP Associates, Inc. (BNP)

F. Belt Tracking 110
G. Floor Supports....111
H. Overhead Supports....111
I. Anchoring 111
J. Lubrication....111
K. Motor Installation....112
L. Jacking Bolt Installation....112
M. Sheave/Sprocket Alignment....112
N. Fasteners 112
O. Shaft Mounted Components....112
P. Painting and Finishing 112
Q. Pavement Markings/Striping....114
R. Safety Signage 114
S. Welding....115
T. Maintenance Access....115

3.6 SPECIAL CONTROL REQUIREMENTS 115
A. Control Stations 115
B. Photocell Functions....116
C. Motor Overloads 120
D. Jam Indication/Restart....120
E. Start-Up Warning....121
F. Alarm Silence....121
G. Emergency Stop Pushbuttons....121
H. Control Stop/Start Crossover Control Stations 122
I. Security/Fire Door....123
J. Fault Warning Alarm 124
K. Motor Safety Disconnect (MSD) 124
L. Breakaway End Cap Safety Guard Interlock 124
M. Interlocks....125
N. Run Lanyards (RL) 125
O. E-Stop Lanyards (ESL)....125
P. Swing Down Ladder Advisory/Warning Flashing Stack Light 125

3.7 SPECIAL CONTROLS CONSIDERATIONS 126
A. Outbound System Input Conveyor (TC1 and TC2) "Manual Start" Sequence 126
B. Outbound Transport Subsystem (OT1) "Manual Start" Sequence....126
C. System Ready Indication 126
D. Keypad Swipe Security Switch....127

3.8 BHS DETAILED CONTROL DESCRIPTIONS/REQUIREMENTS....127
A. General Design Requirements....127
B. Ticket Counter Transport Subsystems 128
C. OT1 Outbound Transport Subsystem....132
D. Ancillary Subsystems (Make-up Unit)....134
E. Ancillary Subsystems (Oversize Slide / Security Door) 135

3.9 BHS PHASED IMPLEMENTATION 136
A. General....136
B. BHS Interim Conditions....137
C. Project Phased Implementation Schedule 138
D. BHS Phased Implementation Summary....138
A. Equipment Removal/Maintain Operations....140
B. Conduit Removal 141
C. Support Steel and Impact Protection Removal....141
D. Equipment/Control Device Reuse....141

3.11 DEMOLISHED MATERIALS TO BE DISPOSED....141
A. General....141

Copyright © 2018 by BNP Associates, Inc. (BNP)

B. Equipment Disposal 141

3.12 OPERATION AND MAINTENANCE TRAINING 141
A. General 141
B. Operational Training 142
C. Maintenance Training 143
D. Supplemental Training 143

PART 4 – CONTRACTOR QUALITY CONTROL REQUIREMENTS 145

4.1 FIELD QUALITY CONTROL 145
A. General 145
B. Quality Control Manual 145
C. Quality Assurance 145
D. Quality Assurance Representative 146
E. Safety Program Manual 146
F. Project Management Office 146
G. Work Activities Bulletin 147
H. Field Quality Control Services 148
I. Approval to Proceed 148
J. Preparatory Inspection 148
K. Initial Inspection 148
L. Follow-Up Inspection 149
M. Inspection Results 149

4.2 INSPECTION/TESTING AND ACCEPTANCE 149
A. Inspection and Testing Procedures 149
B. Conditional Acceptance 155
C. Conditional Acceptance With Defects 156
D. Delayed Conditional Acceptance With Defects List 157
E. Final Acceptance 157

END OF SECTION 347739

Copyright © 2018 by BNP Associates, Inc. (BNP)