S P E C I F I C A T I O N S

NHCS SEA-TECH HIGH SCHOOL
SCIF GRANT RENOVATION & ADDITION

5301 Sidbury Rd.
Wilmington, NC 28429

PROJECT NUBMER: 22-90458

May 16, 2023

Sawyer Sherwood & Associate, P.C.
124 Market Street
Wilmington, NC 28401

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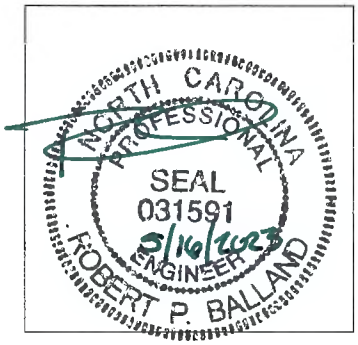
CIVIL

Paramounte Engineering, Inc.
122 Cinema Drive
Wilmington, NC 28403
Tel: 910-791-6707



Robert P. Balland
(Email: rballand@paramounte-eng.com)

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END OF CIVIL SPECIFICATIONS

ARCHITECTURAL

Sawyer Sherwood & Associate Architecture
124 Market Street
Wilmington, NC 28401
Tel: 910-762-0892

Doug Sherwood, AIA
(Email: doug@s2a3.com)

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END OF ARCHITECTURAL SPECIFICATIONS

FOOD SERVICE DESIGN

Foodesign Associates
220 N Ames St. Suite 101
Matthews, NC 28105
Tel: 704-545-1243

John Barja,
(Email: jbarja@foodesignassociates.com)

DIVISION 11 **EQUIPMENT**
11 4000 Food Service Equipment

END OF FOOD SERVICE SPECIFICATIONS.

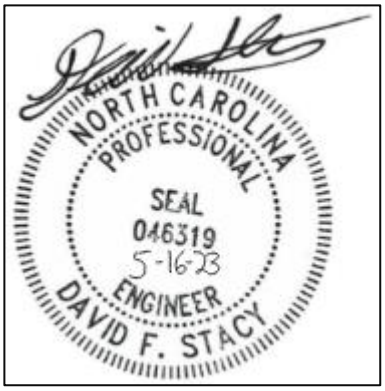
STRUCTURAL

Woods Engineering, PA
254 N. Front Street, Suite 201
Wilmington, NC 28401
Tel: 910-343-8007

Don R. Woods, PE, SE
(Email: donwoods@woodseng.com)

DIVISION 03 **CONCRETE**
03 3000 Cast-in-Place Concrete

END OF STRUCTURAL SPECIFICATIONS



FIRE PROTECTION

Performance Based Fire Protection Engineering, PLLC
PO Box 1847
Pittsboro, NC 27312
Tel: 919-600-7780

David Stacy
(Email: dstacy@pbfpe.com)

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END OF FIRE PROTECTION

PLUMBING & MECHANICAL

CBHF Engineers, PLLC
2246 Yaupon Drive
Wilmington, NC 28401
Tel: 910-791-4000

5/16/2023

Troy O. Grady
(Email: tgrady@cbhfengineers.com)

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ELECTRICAL

CBHF Engineers, PLLC
2246 Yaupon Drive
Wilmington, NC 28401
Tel: 910-791-4000

Jason P. Famiglietti
(Email: jfam@cbhfengineers.com)

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- Affidavit of Capital Improvement Form E-589ci

1. National Guard 425 / 896S
2. Zero 8655 / 65A
3. Reese S205

2.12 DOOR SILENCERS

A. All hollow metal frames shall have gray resilient type silencers. Quantity (3) on single doors and quantity (2) on pair of doors.

2.13 OVERHEAD STOPS

A. Furnish type specified in hardware sets. Through-bolts shall be used for attachment of overhead holders.

B. Acceptable Manufacturers:

1. Glynn Johnson: 90 series
2. Sargent: 1790 series.
3. Rixson: 10 series

2.14 WALL STOPS

A. Furnish a stop or holder for all doors. Furnish floor stops only where specifically indicated. Where wall stops are not applicable, furnish overhead stops. Holder shall not be furnished at fire-rated doors.

B. Acceptable Manufacturers:

1. Ives: WS406/407CCV
2. Trimco: 1270WXCP
3. DCI: 3211

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.

B. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces, which are later to be painted or finished in another way, coordinate removal, storage and reinstallation or application of surface protections with finishing work specified in the Division 09 sections. Do not install surface-mounted items until finishes have been completed on the substrate.

C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units, which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant.

F. Adjust and reinforce attachment substrate for proper installation and operation:

1. Gaskets: Install jamb-applied gaskets before closers, overhead stops, rim strikes, etc.

G. Locate floor stops not more than 4 inches from the wall.

INVITATION TO BID

New Hanover County Schools invites General Contractors to bid on construction of the SEA-Tech SCIF Grant Additions and Renovations. Sealed bids will be received by the Office of Facility Planning & Construction in the New Hanover County Administration Building, Conference Room Admin 101, 6410 Carolina Beach Road Wilmington, North Carolina 28412, at 3:00 on June 15, 2023. All bids will be opened and read aloud starting at 3:00. This project will be bid and awarded in accordance with G.S. 143-128 and G.S. 143-129, Formal Bidding Procedures.

The project consists of construction of a new construction trades building, renovation and expansion of the culinary classroom, construction of a coffee bar, and drainage improvements.

Licensed General Contractors must have a minimum of five (5) years of experience on competitively bid publicly funded construction projects e.g. City, County, State or School Systems.

A Pre-Bid Conference will be held on June 6, 2023, at 10:00 a.m. at SEA-Tech High School, 5301 Sidbury Road, Castle Hayne, NC 28429. The Design Consultant and a representative from New Hanover County Schools will be available at that time to answer questions concerning the project. Questions after that time shall be submitted in writing to the Architect, Doug Sherwood (doug@s2a3.com) at 124 Market Street, Wilmington, NC 28401 or to Leanne Lawrence (leanne.lawrence@nhcs.net), Director of Facility Planning & Construction, New Hanover County Schools 6410 Carolina Beach Road Wilmington, North Carolina 28412.

Complete plans and specifications may be obtained from Sawyer Sherwood & Associate, P.C., beginning May 29, 2023. PDF versions of the construction documents may be obtained by emailing doug@s2a3.com and are available at no cost.

Bid Security in the amount of five percent (5%) of the proposal must accompany each proposal in accordance with the Information for Bidders. No bid may be withdrawn for a period of forty-five days after the opening thereof.

The successful bidder will be required to furnish 100% Performance Bond and a 100% Material Payment Bond.

New Hanover County Schools has a verifiable ten percent (10%) goal for participation by minority businesses in the total value of the work. Bidders are required on school construction and renovation projects to make a "good faith effort" to meet this goal. Bidders shall identify on its bid the minority businesses that it will use on the project. Bidders shall submit along with the bid an affidavit listing the "good faith efforts" it has made pursuant to Section I – Information for Bidders, Article I-8, Minority Participation, and the total dollar value of the bid that will be performed by the minority businesses. A bidder that performs all of the work under the contract with its own workforce may submit an affidavit to that effect in lieu of the aforementioned affidavit otherwise required under this subsection.

New Hanover County Schools reserves the right to reject any and all bids, waive informalities and irregularities in bidding, and to accept bids which are considered to be in the best interest of the School System.

Dated For Publication: May 28, 2023

SECTION I

INFORMATION FOR BIDDERS

I-1. SUBMISSION OF BIDS AND BID OPENING:

A. Bids will be received in accordance with the Invitation to Bid. Bidders, or their representative, and other interested persons may be present at the opening of the Bids.

B. The envelope containing the bid must be sealed and addressed to New Hanover County Schools, Facility Planning & Construction Department, New Hanover County Schools Administration Building, 6410 Carolina Beach Road Wilmington, N.C. 28412. The outside of the envelope should also indicate the name of the Project, the name of the Bidder and the Bidder's North Carolina State Contractor's License Number.

C. The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids. The time with respect to the bid will be the Eastern Time for the United States as maintained by the Time Services Department of the U.S. Naval Observaory: http://www.usno.navy.mil/USNO/time/display-clocks/simpletime . Bids will not be accepted after the time(s) set forth in the Invitation to Bid.

I-2. BIDDING DOCUMENTS:

A. Bidding Documents include the Invitation to Bid, Information for Bidders, Bid Form, the Bid Security (if required), Affidavit's of Minority Participation and the Contract Documents, including any Addenda issued prior to receipt of bids. All requirements and obligations of the Bidding Documents are hereby incorporated by reference into the Contract Documents and are binding on the Successful Bidder upon award of the contract.

B. Bidders may obtain complete sets of the Bidding Documents as designated in the Invitation to Bid in the number and for the deposit, if any, stated therein.

C. Bidders shall use complete sets of Bidding Documents in preparing Bids; neither the Owner nor the Design Consultant shall assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

D. The Owner in making copies of the Bidding Documents available on the above terms does so only for the purpose of obtaining Bids on the Work and does not confer a license or grant for any other use.

I-3. DEFINITIONS:

A. THE BID:

A Bid is a complete and properly signed proposal to do the Work, or designated portion thereof, for the sums stipulated therein, submitted in accordance with the Bidding Documents and G.S. 143-128 and G.S. 143-129.

B. BASE BID:

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 deleted for sums stated in Alternate Bids, if any.

C. ALTERNATES:

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.

D. HE/HIS:

The term He or His is not intended to be gender specific.

I-4. QUALIFICATION OF BIDDER:

A. The Contractor must have been engaged in the performance of the type of work described in the Contract Documents for a period of no less that TWO years prior to submitting a bid.

B. Prior to Contract award or within seven days of the Owner's request to do so, the successful Bidder shall be prepared to provide sufficient references from customers with contracts of similar or greater size and scope, and other proof showing to Owner's satisfaction that Contractor is sufficiently experienced and capable of properly performing its proposed Contract with the Owner. Low Bidders that have failed to successfully perform one or more previous contracts with Owner must provide at least three (3) such references in writing from projects performed subsequent to such low bidder's most recent nonperformance of a contract with the Owner. In addition to references, Contractor must demonstrate that his present organization, direct labor force and prior work experience is of adequate size and development to maintain responsible control of the project and to schedule, coordinate and perform the work in an expeditious manner and in accordance with the Contract Documents.

C. Bidders, whether residents or nonresidents in North Carolina, will be required to show evidence of a valid North Carolina State Contractor's Licence Number before their bids will be considered.

D. The Owner will consider, in determining the qualifications of a Bidder, his record in the performance of any contracts for construction work into which he may have entered with the Owner or with similar public or private bodies or corporations. The Owner expressly reserves the right to reject the bid of any Bidder if such record discloses that such Bidder, in the opinion of the Owner, has not properly performed such contracts or has habitually and without just cause neglected the payment of bills, or has otherwise disregarded his obligations to Subcontractors, material suppliers or employees.

E. The Owner may make such investigation as they deem necessary to determine the ability of the Bidder to perform the work, and the Bidder shall furnish to the Owner all such information and data for this purpose as they may request. The Owner reserves the right to reject any bid if the evidence submitted by, or investigation of such Bidder, fails to satisfy the Owner that such Bidder is a responsive and responsible Bidder in accordance with N.C. Gen. Stat. 143-128 and 143-129, and the criteria set forth herein. The Owner may require AIA

Document A305 Contractor's Qualification Statement (or equivalent). Conditional bids will not be accepted.

I-5. BIDDER'S REPRESENTATIONS:

Each Bidder by submitting his Bid represents that:

A. He has read and understands the Bidding Documents and his Bid is made in accordance therewith; and Bidder agrees to be bound by the terms and requirements set forth in the Bidding and Contract Documents;

B. He has visited the site, has familiarized himself with the local conditions under which the Work is to be performed in accordance with Article I-9 herein, and has correlated his observations with the requirements of the proposed Contract Documents;

C. His Bid is based upon the materials, systems and equipment required by the Bidding Documents without exception; and

D. He has the capability, in all respects, and the moral and business integrity, reliability, technical ability, financial resources, plant, management, superintendents, equipment and materials which will assure effective and efficient good faith performance in full compliance with the Contract Documents and with any and all schedules and Milestone and Completion dates required by the Owner. The Bidder acknowledges and represents in his estimating, planning and scheduling of the Work that the Contract Time has made allowances for normal inclement weather indigenous to the Project Site. The Bidder hereby certifies that the work shall be completed, in place, in full accordance with the Contract Documents, within the time limits specified.

   i. He shall employ a competent superintendent who shall be in attendance on site during all construction activities for the execution of the work. The superintendent shall be approved by the Owner, and shall continue in that capacity on this project for the duration of the project, unless he ceases to be on the Contractor's payroll or the Owner otherwise agrees. The superintendent shall represent the Contractor and all communication given to the superintendent shall be binding as if given to the Contractor.

E. He agrees that upon receipt of the Notice of Award, he will execute the Contract, and will deliver all bonds and proof of insurance coverage as required by the Bidding Documents.

F. He agrees to execute the Contract within ten (10) buisness days from the date of Notice of Award, and in case he fails or neglects to appear within the specified time to execute the Contract, he will be considered as having abandoned the Contract, and any Bid Security accompanying this Proposal will be forfeited to the Owner by reason of such failure on the part of the Bidder.

G. He has made a "good faith effort" to meet New Hanover County School's verifiable ten percent (10%) goal for participation by minority businesses in the total value of the work. The Bidder shall identify on its bid the minority businesses that it will use on the project. The Bidder shall submit along with the bid an affidavit listing the "good faith efforts" it has made pursuant to subsection (f) of G.S. 143-128.2 and the total dollar value of the bid that will be performed by the minority businesses. A bidder that performs all of the work under the

contract with its own workforce may submit an affidavit to that effect in lieu of the aforementioned affidavit otherwise required under this subsection.

H. He has reviewed the General Conditions included in the Bidding Documents.

I-6. BID SECURITY:

A. Each bid must be accompanied by (1) cash; or (2) a Cashier's Check or a Certified Check of the Bidder in an amount not less than 5% of the bid, made payable to the Owner; or (3) a bidder's bond on the Bid Bond Form provided herein or on a similar form which in every respect materially complies with said Bid Bond, in the amount of 5% of his bid. For purposes of this provision, the amount of the bid shall be the Base Bid.The bidder's bond shall be issued by a surety company licensed to conduct business in North Carolina and acceptable to the Owner.

B. Said bid security is given as a guarantee that the Bidder will enter into a contract if awarded the work and, in the case of refusal or failure to so enter into said contract, the security shall be declared forfeited to the Owner. Such security shall be returned to all but the three lowest Bidders within three days after the opening of bids and the remaining security will be returned within 48 hours after the Owner and the successful Bidder have executed the Contract. If no Contract has been awarded or the bidder has not been notified of the acceptance of his bid within forty-five (45) days of the bid opening, the Bidder may withdraw his bid and request the return of his bid security. If, at the Owner's request, the Bidder agrees to extend and maintain his bid beyond the specified 45 days, his bid security will not be returned until the expiration of the period of extension.

I-7. FORFEITURE OF BID BOND**:**

The Successful Bidder, upon his failure or refusal to execute the Contract within ten (10) business days after he has received Notice of Award, shall forfeit to the Owner the security deposited with his bid in accordance with North Carolina General Statute 143-129.

I-8. MINORITY BUSINESS ENTERPRISES

It is the policy of the Owner to encourage the use of minority businesses in all school construction contracts and to have a verifiable goal of ten percent (10%) participation by minority businesses in the total value of the work. It is the intent of this policy that the Owner, as awarding authority for school construction projects, and all Contractors and Subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper, and reasonable to achieve the verifiable goal of ten percent (10%) participation. Each bidder will take specific actions to insure a good faith effort in the recrutment and selection of minority businesses including but not limited to:

SUBMITTED WITH BID:

A. For bids that will include subcontracts: The Bidders must earn at least 50 points from the good faith efforts listed below, and submit with their bid an affidavit identifying which efforts were utilized. This affidavit is Affidavit A – Listing of Good Faith Efforts and is included as an attachment to Section I, Information to Bidders, and Section II, Bid Form.

1. **(10 pts)** Contact minority businesses that could reasonably be expected to submit a quote and that are known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notify them of the nature and scope of the work to be performed.

2. **(10 pts)** Make the construction plans, specifications and requirements available for review by prospective minority businesses, or provide these documents to them at least 10 days before the bids are due.

3. **(15 pts)** Break down or combine elements of work into economically feasible units to facilitate minority participation.

4. **(10 pts)** Work with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.

5. **(10 pts)** Attend prebid meetings scheduled by the public owner.

6. **(20 pts)** Provide assistance in getting required bonding or insurance or provide alternatives to bonding or insurance for subcontractors.

7. **(15 pts)** Negotiate in good faith with interested minority businesses and do not reject 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. **(25 pts)** Provide 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. Assist minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.

9. **(20 pts)** Negotiate 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. **(20 pts)** Provide quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

B. For Bids that include work performed with its own workforce: A Bidder that performs all of the work under a contract with its own workforce may submit with their bid an affidavit to that effect in lieu of the affidavit mentioned in the previous subsection A. This affidavit is Affidavit B – Intent to Perform Contract with Own Forces and is included as an attachment to Section II, Bid Form.

NOTE: The Bidder must include either Affidavit A – Listing of Good Faith Efforts or Affidavit B – Intent to Perform Contract with Own Worfforce with its bid. Failure to include either of these affidavits with the bid may result in declaring the bid non-responsive.

C. Each Bidder shall identify on its bid the minority businesses that it will use on the project and the cooresponding dollar value of the bid. Section II, Bid Form, provides space for the Bidder to enter this information.

SUBMITTED BY THE LOWEST RESPONSIBLE, RESPONSIVE BIDDER WITHIN 72 HOURS AFTER NOTIFICATION OF BEING LOW BIDDER

D. An affidavit that includes a description of the portion of work to be executed by the minority businesses, expressed as a percentage of the total contract price, which is equal to or greater than the verifiable ten percent (10%) goal. This affidavit is Affidavit C – Portion of the Work to be Performed by Minority Firms and is included as an attachment to Section II, Bid Form.

E. Documentation of its good faith effort to meet the verifiable ten percent (10%) goal. The documentation must include evidence of all good faith efforts that were implemented, including any advertisements, solicitations, and evidence of other specific actions demonstrating recruitment and selection of minority businesses for participation in the contract. This affidavit is Affidavit D – Good Faith Efforts and is included as an attachment to Section II, Bid Form.

NOTE: The lowest responsible and responsive bidder must submit either Affidavit C – Portion of the Work to be Performed by Minority Firms or Affidavit D – Good Faith Efforts within 72 hours after notification of being low bidder. Failure to submit either of these affidavits within the time provided may result in declaring the bid non-responsive.

I-9. SITE CONDITIONS AND CONDITIONS OF THE WORK:

A. Each bidder must acquaint himself thoroughly as to the character and nature of the work to be done. Each bidder furthermore must make a careful examination of the site of the work and inform himself fully as to the difficulties to be encountered in the performance of the work, the facilities for delivering, storing and placing materials and equipment, and other conditions relating to construction and labor.

B. No plea of ignorance of conditions that exist or may hereafter exist on the site of the work, or difficulties that may be encountered in the execution of the work, as a result of failure to make necessary investigations and examinations, will be accepted as an excuse for any failure or omission on the part of the successful Bidder to fulfill in every detail all the requirements of the Contract Documents and to complete the work or the consideration set forth therein, or as a basis for any claim whatsoever.

C. Insofar as possible, the Successful Bidder, in carrying out his work, must employ such methods or means as to not cause interruption of or interference with the work of the Owner or any separate contractor.

I-10. BIDDER'S QUESTIONS, ADDENDA AND INTERPRETATIONS:

A. Bidders and Sub-bidders shall promptly notify the Design Consultant of any ambiguity, inconsistency or error which they may discover upon examination of the Bidding and Contract Documents or of the site and local conditions. No interpretation of the meaning of the drawings, specifications or other contract documents will be made to any Bidder orally.

B. Every request for such interpretation should be in writing addressed to the Design Consultant with a copy forwarded to the Owner.

C. Any and all such interpretations and any supplemental instructions will be in the form of written addenda to the Bidding Documents which, if issued, will be transmitted to all prospective Bidders (at the respective addresses furnished for such purposes) no later than three calendar days prior to the date fixed for the opening of bids. Neither the Design Consultant nor the Owner will be responsible for any other explanations or interpretations of the proposed documents. Failure of any Bidder to receive any such addenda or interpretation shall not relieve any bidder from any obligation under his bid as submitted. All addenda so issued shall become part of the Contract Documents.

D. Each Bidder shall ascertain prior to submitting his bid that he has received all Addenda issued, and he shall acknowledge receipt and inclusion in his proposal of all Addenda.

F. The Design Consultant and a representative from New Hanover County Schools will be available at a Pre-Bid Conference to answer questions concerning the project. The date and time of the Pre-Bid Conference shall be determined in the Invitation to Bid. Questions after that time shall be submitted in writing to the Design Consultant or to Leanne Lawrence, Director of Facility Planning & Construction New Hanover County Schools 6410 Carolina Beach Road Wilmington, North Carolina 28412.

I-11. SECURITY FOR FAITHFUL PERFORMANCE:

A. Performance and Payment Bonds:

The Successful bidder shall furnish a Performance Bond in an amount equal to one hundred percent (100%) of the Contract Sum as security for the faithful performance of this Contract and also a Labor and Material Payment Bond in an amount not less than one hundred percent (100%) of the Contract Sum, as security for the payment of all persons performing labor and furnishing materials under this Contract. The successful Bidder shall provide a Performance Bond and a Labor and Material Payment Bond, in accordance with State law and shall be delivered to the Owner no later than the date of execution of the Contract by the successful Bidder.

I-12. TIME OF COMPLETION AND LIQUIDATED DAMAGES FOR NON-COMPLETION:

The time for completion of this Contract and liquidated damages for non-completion within the stipulated time shall be as fixed in the Bid Documents.

I-13. LOCATION OF WORK:

The site of the proposed work is on Owner owned property, public streets, easements and/or other right-of-ways, as shown on the drawings.

I-14. LIABILITY INSURANCE AND WORKMEN'S COMPENSATION:

The Successful Bidder will be required to maintain Commercial General Liability, Workmen's Compensation and other insurance in the amounts and under the terms stipulated in the Contract.

I-15. BIDDERS REFERRED TO LAWS:

A. The attention of Bidders is called to the provisions of all Municipal, County, State and Federal laws, regulations, ordinances and resolutions, including but not limited to, (the Human Rights Ordinance; the Equal Opportunity, Small and Minority Business Enterprises and the Construction Safety Resolutions); as well as laws, regulations, ordinance resolutions and permits relating to obstructing streets, maintaining signals, storing and handling of explosives, affecting the Bidder, or his employees or his work hereunder in his relation to the Owner or any other person. The Bidder shall obey all such laws, regulations, ordinances, permits or resolutions controlling or limiting Contractors while engaged in the prosecution of work under this Contract.

B. The provisions of this Contract shall be interpreted in accordance with the laws of North Carolina and in accordance with the laws, ordinances, regulations, permits and resolutions of local Municipalities and New Hanover County.

I-16. TAXES

All applicable Federal, State and Local Taxes shall be included in the Bidder's proposal. The successful bidder shall provide the Owner with documentation of North Carolina sales taxes paid for all purchases on the project in a form provided by the Owner and included as an attachment to this Section II, Bid Form.

I- 17. RIGHT TO REJECT BIDS:

The Owner expressly reserves the right to reject any or all bids, to waive any informalities or irregularities in the bids received, and to accept that bid which in its judgment, best serves the interest of the Owner.

I-18. EQUAL PRODUCTS AND SUBSTITUTIONS:

A. Whenever possible, the Design Consultant shall specify in the plans the required performance and design characteristics for materials as required by N.C. Gen. Stat. § 133-3. When it is impossible or impractical to specify the required performance and design characteristics for materials, the Design Consultant may use a certain brand, make, manufacturer, article, device, product, material, fixture, form or type construction by name, make or catalog number to convey the general style, type, character and standard of quality of the article desired. Unless specifically stated to the contrary, any Bidder may, with Owner approval, use any article, device, product, material, fixture, form or type of construction which in the judgment of the Design Consultant is equal to that specified considering quality, workmanship, economy of operation, durability, suitably for the purpose intended, and acceptability for use on the project. Such requests must be submitted five (5) days prior to bid opening date. Approval by the Owner prior to bid opening will be in the form of an Addendum to the Specifications issued to all prospective Bidders indicating that the additional makes or brands appear to be equivalent to those specified. Nothing in this paragraph is intended to restrict or inhibit free and open competition on school system projects.

B. The Bidder may request approval for substitutions after award of the Contract in accordance with the provisions of Article 4.15 of the General Conditions.

I-19. PREPARATION AND SUBMITTAL OF BID:

A. Bids shall be submitted utilizing the Bid Form as bound herein as Section II, or otherwise provided with the Contract Documents, and shall be complete in every respect. The total bid amount shall be entered in words and figures in the space provided. Where applicable, the unit price or lump sum items, and their extensions, shall be entered in figures in the respective columns provided for each bid item. All entries shall be typewritten or printed in ink. The signatures of all persons shall be in longhand. Any entry of amount that appears on the face of the bid to have involved an erasure, deletion, white-out and/or substitution or other such change or alteration, shall show by them the initials of the person signing the bid and the date of the change or alteration. A failure to comply with this requirement may be cause for disqualification of the bid.

B. For Unit Price bids, in the event of any discrepancies between the unit prices and the extensions thereof or the total bid amount, the unit prices shall govern. For Lump Sum bids, in the event of a discrepancy between the bid amount in writing and that in figures, the written value shall govern.

C. Bids shall not contain any restatement or qualifications of work to be done, and alternate bids will not be considered unless called for. No oral bids or modifications will be considered.

C. Each single-prime bid shall identify the major subcontractors, including but not limited to the contractors selected to perform the site, mechanical, electrical and plumbing portions of the work, and the subcontractors' respective bid prices for the work.

I-20. MODIFICATION OR WITHDRAWAL OF BID:

A. A Bidder may withdraw his bid from consideration if such bid was based upon a mistake as provided in North Carolina General Statute 143-129.1.

B. Prior to the time and date designated for receipt of bids, any bid submitted may be modified or withdrawn by notice to the party receiving bids at the place designated for receipt of bids.

C. Withdrawn bids may be resubmitted up to the time designated for the receipt of Bids provided that they are then fully in conformance with this Information for Bidders.

D. Bid security, if any is required, shall be in an amount sufficient for the bid as modified or resubmitted.

I- 21. DETAILED BID BREAKDOWN:

If the Owner directs, the Bidder shall provide a detailed breakdown of his bid acceptable to the Owner. In addition to verifying accounting requirements, the breakdown may be used by the Owner to determine whether the Bidder has grossly misjudged the requirements of any area. Failure to provide the requested detailed breakdown may result in rejection of the Bid.

I- 22. AWARD OF CONTRACT:

The contract will be awarded to the lowest responsive and responsible Bidder taking into consideration quality, performance, and the time specified in the bids for the performance of the contract.

A. The lowest single prime bidder shall be determined by the aggregate amount of the unit prices set forth in the Bid, if work is bid on a unit price basis, or the aggregate amount of the Base Bid, plus any Alternates selected by the Owner. Bids will be received and awarded according to state law.

B. A Responsive Bidder shall mean a Bidder who has submitted a bid which conforms, in all material respects, to the Bidding Documents.

C. A Responsible Bidder shall mean a Bidder who has the capability, in all respects, to perform fully the contract requirements and the moral and business integrity and reliability which will assure good faith performance. In determining responsibility, the following criteria will be considered:

1. The ability, capacity and skill of the Bidder to perform the contract or provide the service required;

2. Whether the bidder can perform the contract or provide the service promptly, or within the time specified, without delay or interference;

3. The character, integrity, reputation, judgment, experience and efficiency of the Bidder;

4. The quality of performance of previous contracts or services. For example the following information will be considered:

   a. The administrative and consultant cost overruns incurred by Owners on previous contracts with Bidder,

   b. The Bidder's compliance record with contract general conditions on other projects,

   c. The submittal by the bidder of excessive and/or unsubstantiated extra cost proposals and claims on other projects,

   d. The Bidder's record for completion of the work within the Contract Time or within Contract Milestones and Bidders compliance with scheduling and coordination requirements on other projects,

   e. The Bidder's demonstrated cooperation with the Owner or the Design Consultant and other contractors on previous contracts,

   f. Whether the work performed and materials furnished on previous contracts was in accordance with the Contract Documents;

5. The previous and existing compliance by the Bidder with laws and ordinances relating to contracts or services;

6. The sufficiency of the financial resources and ability of the Bidder to perform the contract or provide the service;

7. The quality, availability and adaptability of the goods or services to the particular use required;

8. The ability of the Bidder to provide future maintenance and service for the warranty period of the contract;

9. Whether the Bidder is in arrears to the Owner on debt or contract or is a defaulter on surety to the Owner;

10. Whether the Bidder has demonstrated a good faith effort to use M/WBE's as subcontractors;

11. Such other information as may be secured by the Owner having a bearing on the decision to award the contract, to include, but not limited to:

    a. The ability, experience and commitment of the Bidder to properly and reasonably plan, schedule, coordinate and execute the Work,

    b. Whether the Bidder has ever been debarred from bidding or found ineligible for bidding on any other projects.

D. The purpose of the above is to enable the Owner in its opinion, to select the lowest responsible bidder. The ability of the low Bidder to provide the required bonds will not of itself demonstrate responsibility of the Bidder.

E. The Owner reserves the right to require from the Bidder: (1) submissions of references, within seven days of bid opening, to include a listing of previous and current projects and (2) financial statements indicating current financial status, prepared in accordance with generally accepted accounting principles, by a CPA licensed to do business in North Carolina, (3)AIA Document A305 Contractor's Qualification Statement and (4) any other information deemed necessary in order to establish the responsiveness and responsibility of the bidder.

F. The Owner reserves the right to defer award of this contract for a period of forty-five (45) days after the due date of bids. During this period of time, the Bidder shall guarantee the prices quoted in his bid.

I- 23. FINAL COMPLETION AND FINAL PAYMENT REQUIREMENTS:

1. When the Design Consultant and the Owner find the Work acceptable under the Contract Documents and the Contract fully performed, they will approve a final Certificate of Payment stating that to the best of their knowledge, information and belief, and on the basis of their observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor, and noted in said final Certificate, is due and payable, except for an amount mutually agreed upon for any work remaining incomplete or uncorrected for which the Owner is entitled a credit under the Contract Documents. If the Design Consultant and the Owner find the Work to be incomplete or unacceptable, the costs of reinspections shall be paid by the Contractor.

2. Final Payment shall not be made to the Contractor until all of the required project close-out documents, as listed on the Close-Out Document Checklist, have been submitted and approved.

END OF SECTION I - INFORMATION FOR BIDDERS

FACILITY PLANNING & CONSTRUCTION
PROJECT EXHIBIT C
MANAGEMENT PLAN
Revised 03.14.23

Project: SEA-Tech High School SCIF Grant
Project No: 22-90458

D/D to NHCS Staff (with cost estimate)	January 16, 2023
D/D to NC State Dept. of Public Instruction	January 16, 2023
D/D Review Meeting with NHCS	February 8, 2023
D/D Approval (with comments noted)	February 10, 2023
C/D to NHCS Staff (with cost estimate)	April 10, 2023
C/D to NC State Dept. of Public Instruction	April 10, 2023
C/D Review Meeting with NHCS	April 27, 2023
C/D Approval (with comments noted)	April 28, 2023
Advertise for Bid (Formal)	May 28, 2023
Prebid Conference	June 6, 2023
Receive NC State Dept. of Public Instruction Approval	June 9, 2023
Receive Bids	June 15, 2023
Notice of Intent to Award	June 16, 2023
GC to submit for building permit	June 20, 2023
Bids to Board of Education	July 11, 2023
Notice to Proceed with Contract Activities	July 14, 2023
Pre-construction Conference	July 18, 2023
Phase 1 Shop Building- NTP with Work on Site	July 18, 2023
Phase 2 Interior Renovation- NTP with Work on Site	December 15, 2023
Phase 2 Interior Renovation- Substantial Completion	March 30, 2024
Phase 1 Shop Bldg- Substantial Completion	June 1, 2024
Phase 1 and 2- Final Completion	July 1, 2024
Eleven Month Warranty Inspection	February 28, 2025
Completion of Warranty items	March 28, 2025

SECTION II

BID FORM

FOR: SEA-Tech High School SCIF Grant Additions and Renovations
22-90458

TO: New Hanover County Schools
Facility Planning & Construction Department
6410 Carolina Beach Road
Wilmington, North Carolina 28412

FROM: _____
BIDDER

_____
ADDRESS

_____
CITY STATE ZIP

_____
PHONE FAX EMAIL ADDRESS

1. BASE BID PROPOSAL:

Having become completely familiar with the local conditions affecting the cost of work at the place where work is to be executed, and having carefully examined the site conditions as they currently exist, and having carefully examined the Bidding Documents prepared by Sawyer Sherwood & Associate, P.C. and titled SEA-Tech High School SCIF Grant Additions and Renovations dated May 16, 2023 together with any addenda to such Bidding Documents as listed hereinafter, the undersigned hereby proposes and agrees to provide all labor, materials, plant, equipment, transportation and other facilities as necessary and/or required to execute all of the work described by the aforesaid Bidding Documents for the lump sum consideration of: (Bidder shall write in the amount of the base bid here) _____

_____ Dollars ($ _____)

Total of Allowances $ 30,000.00

Total Base Bid_____

said amount being hereinafter referred to as the Total Base Bid or Total Base Bid Proposal.

2. ALTERNATES:

The undersigned proposes to perform alternates for stated 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 alternate. (Bidder shall write in the amounts for the alternates listed below)

ALTERNATE NO. G-1: Renovation and Expansion of Culinary Classroom

Adjust Base Bid by ADDING _____

_____ Dollars ($ _____)

ALTERNATE NO. G-2: Coffee Bar

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

ALTERNATE NO. G-3: Door Hardware

Alternate No. G-3.1: Exit Devices by Von Duprin

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

Alternate No. G-3.2: Continuous and Non-Continuous Hinges by Ives

Adjust Base Bid by ADDING _____

_____ Dollars ($ _____)

Alternate No. G-3.3: Locks/Latches by Yale

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

Alternate No. G-3.4: Cylinder/Keyway by Yale

Adjust Base Bid by ADDING _____

_____ Dollars ($ _____)

Alternate No. G-3.5: Door Closers by LCN

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

Alternate No. G-3.6: Electronic Locks by Schlage

Adjust Base Bid by ADDING_____

Alternate No. G-3.7: AD400s by Schlage

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

ALTERNATE NO. G-4: Cameras to be Panasonic iPro series

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

ALTERNATE NO. G-5: Intercom to be by Bogen

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

ALTERNATE NO. G-6: Emergency Panic Alarm by United Security Projects

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

ALTERNATE NO. G-7: Security Alarm system by Honeywell Ademco Vista

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

ALTERNATE NO. G-8: Access Video Intercom System by AiPhone

Adjust Base Bid by ADDING_____

_____ Dollars ($ _____)

3. SUBCONTRACTOR LISTING

Bidders are requested to identify below the names of major subcontractors, including but not limited to contractors selected to perform the site, mechanical, electrical and plumbing portions of the work, and the subcontractors' respective bid prices for the work. This information is requested to be submitted at bid time.

Name of Subcontractor	Amount of Bid

4. BID BREAKDOWN:

Not used.

5A. UNIT PRICES

Not used.

5B. ALLOWANCES

Total Base Bid includes all cash allowances listed below. Unused amounts will be credited to the Owner by Change Order at the end of the project.

Owner Allowance: $30,000.00

TOTAL OF ALLOWANCES: $30,000.00

6. SCHEDULE / WORKING HOURS

The following dates shall be adhered to unless modified by written agreement between Owner and Contractor, and executed as a Change Order to the Contract.

Notice to Proceed: Contract Activities	July 14, 2023
Ph. 1 Constr. Trades Bldg. Notice to Proceed on Site	July 18, 2023
Ph. 2 Int. Renov. Notice to Proceed on Site	December 15, 2023
Ph. 2 Int. Renov. Substantial Completion	March 30, 2024
Ph. 1 Constr. Trades Bldg. Substantial Completion	June 1, 2024
Ph. 1 and Ph. 2 Final Completion:	July 1, 2024

Owner reserves the right to withhold Notice to Proceed by up to 30 days. Contractor may not begin work until a written Notice to Proceed is issued. For each day that the Notice to Proceed is withheld pursuant to this paragraph, the dates established for Substantial and Final Completion shall be adjusted. The Contractor shall not be entitled to additional compensation if the Owner withholds the issuance of the Notice to Proceed pursuant to this paragraph. If Notice to Proceed is withheld due to Contractor delays, no adjustment of completion times will be granted.

Normal working days and hours are: Monday through Friday, 7:00 a.m. – 5:00 p.m., excluding school Holidays.

7. MINORITY BUSINESSES:

Please circle the Ownership category of Bidder's firm:
Non-Minority / Black / Hispanic / Asian-American / American Indian / White Female / Socially & Economically Disadvantaged.

If Ownership is Minority Female (circle):
NO – Firm is not minority owned.
YES – Firm is minority-female owned.

Source of Ownership category (certification/ verification) (circle one):
Not Applicable / State of NC HUB / State of NC DOT / Local Agency / Federal Agency / Out-of State Agency / Self-Identified / Unknown

Each Bidder shall identify on its bid the minority businesses that it will use on the project and the corresponding total dollar value of the bid. (Bidder shall write in the names and subcontract amount of minority businesses used in bid)

Name of Minority Business	Subcontract Amount
TOTAL:	

In addition to the information above, the Bidder must complete and provide with the bid one of the following affidavits:

Affidavit A – Listing of Good Faith Efforts
This affidavit documents the good faith efforts of the Bidder and is to be submitted with the bid if the Bidder is subcontracting portions of the work.

Affidavit B – Intent to Perform Contract with Own Forces
This affidavit documents the intent of the Bidder to perform the contract with its own workforce and is to be submitted with the bid if the Bidder is not subcontracting portions of the work.

NOTE: The Bidder must include either Affidavit A or Affidavit B with the Bid. Failure to include either of these affidavits may result in declaring the bid non-responsive.

8. ADDENDA ACKNOWLEDGEMENT:

The undersigned acknowledges receipt of the following addenda: (Bidder to write in the number and date appearing on each addendum received)

Addendum No.	Date	Addendum No.	Date

9. BID SECURITY:

Bid security in the amount of five (5) percent of the Base Bid is attached, without endorsement, in the sum of_____Dollars ($_____) which is to become the property of the Owner in the event the Contract and Performance and Payment Bonds are is not executed within the time set forth, as liquidated damages for the delay and additional work caused to the Owner.

10. The undersigned declares that the person or persons signing this Bid is/are fully authorized to sign on behalf of the firm listed and to fully bind the firm listed to all the Bid's conditions and provisions thereof.

11. It is agreed that no person or persons or company other than the firm listed below or as otherwise indicated has any interest whatsoever in this Bid or the contract that may be entered into as a result of the Bid and that in all respects the Bid is legal and firm, submitted in good faith without collusion or fraud.

12. It is agreed that the undersigned has complied or will comply with all requirements of local, state, and national laws, and that no legal requirement has been or will be violated in making or accepting this Bid, in awarding the Contract to him and/or in the prosecution of the work required.

13. It is agreed that the undersigned shall provide any information deemed necessary by the Owner to establish the responsiveness and responsibility of the bidder.

14. The undersigned acknowledges that he has received a copy of the Owner–Contractor Agreement.

15. The following information is provided pursuant to the Contract Documents:

1. Legal Name of Firm:

_____

a. If Firm is a corporation, state that corporation is organized under the laws of the State of _____ Please affix corporate seal to this Bid Form.

b. If Firm is a partnership, state names of partners: _____

_____

c. If Firm is an individual using a trade name, state name of individual: _____

_____

2. North Carolina Contractor's License Number: _____

Respectfully submitted, this

_____ day of _____, 20__

(Signature) _____

(Name Typed) _____

(Title) _____

(SEAL IF BIDDER IS A CORPORATION)

END OF SECTION II – BID FORM

Enclosure

1. Either Affidavit A or B
2. Bid Bond

AFFIDAVIT A

Listing of Good Faith Efforts

County of _____

Affidavit of_____
(Name of Bidder)

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive.

- ❑ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ❑ **2 --(10 pts)** Made 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 bids are due.
- ❑ **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ❑ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ❑ **5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- ❑ **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ❑ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject 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 – (25 pts)** Provided 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. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ❑ **9 – (20 pts)** Negotiated 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 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

AFFIDAVIT B

Intent To Perform Contract With Own Forces

County of _____

Affidavit of_____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of _____

Subscribed and sworn to before me this _____day of _____20 ____

Notary Public _____

My commission expires_____

AFFIDAVIT C

Portion of the Work to be Performed by Minority Firms

County of _____

(Note: this form is to be submitted ONLY by the apparent lowest responsible, responsive bidder. This form is not to be included with bid.)

If the portion of the work to be executed by minority businesses as defined in GS143-128.2(g) is equal to or greater than 10% of the bidder's total contract price, then the Bidder must complete this affidavit.
Either Affidavit C or Affidavit D shall be provided by the apparent lowest responsible, responsive Bidder within **72 hours** after notification of being low Bidder.

Affidavit of _____I do hereby certify that
(Name of Bidder)

on the _____
(Project Name)

Project ID#_____Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required.

Name and Phone Number	*Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**), American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

AFFIDAVIT D

Good Faith Efforts

County of _____

(Note: this form is to be submitted ONLY by the apparent lowest responsible, responsive bidder. This form is not to be included with bid.)

If the goal of 10% participation by minority business **is not** achieved, the Bidder must complete this affidavit.
Either Affidavit C or Affidavit D shall be provided by the apparent lowest responsible, responsive Bidder within **72 hours** after notification of being low Bidder.

Affidavit of: _____
(Name of Bidder)

I do certify the attached documentation as true and accurate representation of my good faith efforts. Attach additional sheets if required

Name and Phone Number	Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**), Socially and Economically Disadvantaged (**D**)

Documentation of the Bidder's good faith efforts to meet the goals set forth in these provisions. Examples of documentation include, but are not limited to, the following evidence:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
B. Copies of quotes or responses received from each firm responding to the solicitation.
C. A telephone log of follow-up calls to each firm sent a solicitation.
D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
F. Copy of pre-bid roster.
G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
H. Letter detailing reasons for rejection of minority business due to lack of qualification.
I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of_____

Subscribed and sworn to before me this _____day of _____20_____

Notary Public_____

My commission expires _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, That we,

_____
(Bidder's Name)

_____, of _____
(Street Address) (City, State, Zip)

hereinafter called the Principal, and

_____
(Surety's Name)

a corporation organized and existing under the Laws of the State of _____, and authorized to transact business in the State of _____, as Surety, hereinafter called Surety, are held and firmly bound unto _____ as the Owner and hereinafter called Obligee, in the Penal sum of five percent (5%) of the amount bid, good and lawful money of the United States of America, for the payment of which the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The Condition of this Obligation is such, that, WHEREAS the Principal has submitted a proposal to the Obligee on a contract for the construction

of _____
(Contract Name and Number)

NOW THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the Bidding or Contract Documents with good and sufficient surety for the faithful performance of such construction for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void; otherwise to remain in full force and effect.

In witness whereof, we have hereunto set our signatures and seal this _____ day of _____, 20_____, all pursuant to due authorization.

_____ (Seal)
Principal / Owner

By _____ Surety

By _____
Attorney-in-Fact in accordance
with the attached Power of Attorney

STATE OF _____)

COUNTY OF _____)

I, _____, a Notary Public in and for the State and County aforesaid, do hereby certify that _____, and _____, whose names are signed to the foregoing bond, this day personally appeared before me in my State and County aforesaid and acknowledged the same.

Given under my hand seal this _____ day of _____, 20_____.

_____ (Seal)
Notary Public

_____
My Commission expires:

AFFIDAVIT A

Listing of Good Faith Efforts

County of _____

Affidavit of_____
(Name of Bidder)

I have made a good faith effort to comply under the following areas checked:

Bidders must earn at least 50 points from the good faith efforts listed for their bid to be considered responsive.

- ❑ **1 – (10 pts)** Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed.
- ❑ **2 --(10 pts)** Made 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 bids are due.
- ❑ **3 – (15 pts)** Broken down or combined elements of work into economically feasible units to facilitate minority participation.
- ❑ **4 – (10 pts)** Worked with minority trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of minority businesses.
- ❑ **5 – (10 pts)** Attended prebid meetings scheduled by the public owner.
- ❑ **6 – (20 pts)** Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.
- ❑ **7 – (15 pts)** Negotiated in good faith with interested minority businesses and did not reject 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 – (25 pts)** Provided 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. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help minority businesses in establishing credit.
- ❑ **9 – (20 pts)** Negotiated 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 - (20 pts)** Provided quick pay agreements and policies to enable minority contractors and suppliers to meet cash-flow demands.

The undersigned, if apparent low bidder, will enter into a formal agreement with the firms listed in the Identification of Minority Business Participation schedule conditional upon scope of contract to be executed with the Owner.

The undersigned hereby certifies that he or she has read the terms of the minority business commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

AFFIDAVIT B

Intent To Perform Contract With Own Forces

County of _____

Affidavit of_____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of _____

Subscribed and sworn to before me this _____day of _____20 ____

Notary Public _____

My commission expires_____

AFFIDAVIT C

Portion of the Work to be Performed by Minority Firms

County of _____

(Note: this form is to be submitted ONLY by the apparent lowest responsible, responsive bidder. This form is not to be included with bid.)

If the portion of the work to be executed by minority businesses as defined in GS143-128.2(g) is equal to or greater than 10% of the bidder's total contract price, then the Bidder must complete this affidavit.
Either Affidavit C or Affidavit D shall be provided by the apparent lowest responsible, responsive Bidder within **72 hours** after notification of being low Bidder.

Affidavit of _____I do hereby certify that
(Name of Bidder)

on the _____
(Project Name)

Project ID#_____Amount of Bid $_____

I will expend a minimum of _____% of the total dollar amount of the contract with minority business enterprises. Minority businesses will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below. Attach additional sheets if required.

Name and Phone Number	*Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**), American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with Minority Firms for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of_____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

AFFIDAVIT D

Good Faith Efforts

County of _____

(Note: this form is to be submitted ONLY by the apparent lowest responsible, responsive bidder. This form is not to be included with bid.)

If the goal of 10% participation by minority business **is not** achieved, the Bidder must complete this affidavit.
Either Affidavit C or Affidavit D shall be provided by the apparent lowest responsible, responsive Bidder within **72 hours** after notification of being low Bidder.

Affidavit of: _____
(Name of Bidder)

I do certify the attached documentation as true and accurate representation of my good faith efforts. Attach additional sheets if required

Name and Phone Number	Minority Category	Work description	Dollar Value

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**), Socially and Economically Disadvantaged (**D**)

Documentation of the Bidder's good faith efforts to meet the goals set forth in these provisions. Examples of documentation include, but are not limited to, the following evidence:

A. Copies of solicitations for quotes to at least three (3) minority business firms from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
B. Copies of quotes or responses received from each firm responding to the solicitation.
C. A telephone log of follow-up calls to each firm sent a solicitation.
D. For subcontracts where a minority business firm is not considered the lowest responsible sub-bidder, copies of quotes received from all firms submitting quotes for that particular subcontract.
E. Documentation of any contacts or correspondence to minority business, community, or contractor organizations in an attempt to meet the goal.
F. Copy of pre-bid roster.
G. Letter documenting efforts to provide assistance in obtaining required bonding or insurance for minority business.
H. Letter detailing reasons for rejection of minority business due to lack of qualification.
I. Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

Failure to provide the documentation as listed in these provisions may result in rejection of the bid and award to the next lowest responsible and responsive bidder.

Date:_____Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of_____

Subscribed and sworn to before me this _____day of _____20_____

Notary Public_____

My commission expires _____

BID BOND

KNOW ALL MEN BY THESE PRESENTS, That we,

_____
(Bidder's Name)

_____, of _____
(Street Address) (City, State, Zip)

hereinafter called the Principal, and

_____
(Surety's Name)

a corporation organized and existing under the Laws of the State of _____, and authorized to transact business in the State of _____, as Surety, hereinafter called Surety, are held and firmly bound unto _____ as the Owner and hereinafter called Obligee, in the Penal sum of five percent (5%) of the amount bid, good and lawful money of the United States of America, for the payment of which the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The Condition of this Obligation is such, that, WHEREAS the Principal has submitted a proposal to the Obligee on a contract for the construction

of _____
(Contract Name and Number)

NOW THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the Bidding or Contract Documents with good and sufficient surety for the faithful performance of such construction for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void; otherwise to remain in full force and effect.

In witness whereof, we have hereunto set our signatures and seal this _____ day of _____, 20_____, all pursuant to due authorization.

_____ (Seal)
Principal / Owner

By _____ Surety

By _____
Attorney-in-Fact in accordance
with the attached Power of Attorney

STATE OF _____)

COUNTY OF _____)

I, _____, a Notary Public in and for the State and County aforesaid, do hereby certify that _____, and _____, whose names are signed to the foregoing bond, this day personally appeared before me in my State and County aforesaid and acknowledged the same.

Given under my hand seal this _____ day of _____, 20_____.

_____ (Seal)
Notary Public

_____
My Commission expires:

SECTION III

OWNER – CONTRACTOR AGREEMENT

PROJECT NAME: **SEA-Tech SCIF Grant Additions and Renovations**

PROJECT NUMBER: 22-90458

THIS AGREEMENT, made this 11th day of July, Two Thousand and Twenty-Three by and between New Hanover County Board of Education (herein referred to as the "Owner"), whose mailing address is 6410 Carolina Beach Road, Wilmington, North Carolina 28412 and _____. (herein referred to as the "Contractor"), whose mailing address is _____. Correspondence, submittals, and notices relating to or required under this Contract shall be sent in writing to the above addresses; unless either party is notified in writing by the other, of a change in address.

WITNESSETH:

WHEREAS, it is the intent of the Owner to obtain the services of the Contractor in connection with the new construction of the SEA-Tech SCIF Grant Additions and Renovations (hereinafter referred to as the "Project" or the "Work"); and

WHEREAS, the Contractor desires to perform such construction in accordance with the terms and conditions of this Agreement,

NOW, THEREFORE, in consideration of the promises made herein and other good and valuable consideration, the following terms and conditions are hereby mutually agreed to, by and between the Owner and Contractor:

Article 1

DEFINITIONS

1.1 All terms in this Agreement which are defined in the Information for Bidders and the General Conditions shall have the meanings designated therein.

1.2 The Contract Documents are as defined in the General Conditions. Such documents form the Contract, and all are as fully a part thereof as if attached to this Agreement or repeated herein. The Contract Documents consist of the Owner-Contractor Agreement, the General Conditions of the Contract, the Drawings, the Specifications, all Addenda issued prior to bidding, and all Modifications and Change Orders issued after execution of the Contract.

Article 2

STATEMENT OF THE WORK

2.1 The Project is the Work identified in the drawings and specifications prepared by Sawyer Sherwood & Associate, P.C. dated May 16, 2023 for New Hanover County Board of Education, titled SEA-Tech High School SCIF Grant Additions and Renovations, including the following addenda:

_____

2.2 The Parties agree that the Project shall include the following alternates:

_____

2.3 The Parties agree to the following modifications to the Project's drawings and specifications, including the noted value engineering items:

List item(s) and proposed deduct/add(s). If none, delete this language list "None"

2.4 The Parties agree that the following allowances are included in the Contract Sum in Section 5.1 below:

Owner Allowance: $30,000.00

2.5 The Contractor shall provide and pay for all materials, tools, equipment, labor and professional and non-professional services, and shall perform all other acts and supply all other things necessary, to fully and properly perform and complete the Work, as required by the Contract Documents.

2.6 The Contractor shall further provide and pay for all related facilities described in any of the Contract Documents, including all work expressly specified therein and such additional work as may be reasonably inferred therefrom, saving and excepting only such items of work as are specifically stated in the Contract Documents not to be the obligation of the Contractor. The totality of the obligations imposed upon the contractor by this Article and by all other provisions of the Contract Documents, as well as the structures to be built and the labor to be performed, is herein referred to as the "Work".

Article 3

DESIGN CONSULTANT

3.1 The Design Consultant (as defined in the General Conditions) shall be Sawyer Sherwood & Associate, P.C. whose address is 124 Market Street, Wilmington, NC 28401, however, that the Owner may, without liability to the Contractor, unilaterally amend this Article from time to time by designating a different person or organization to act as its Design Consultant and so advising the Contractor in writing, at which time the person or organization so designated shall be the Design Consultant for purposes of this Contract.

Article 4

TIME OF COMMENCEMENT AND COMPLETION

4.1 The Contractor shall commence the Work promptly upon the date established in the Notice to Proceed. If there is no Notice to Proceed, the date of commencement of the Work shall be the date of this Agreement or such other date as may be established herein.

4.2 Time is of the essence. The Contractor shall achieve Final Completion, as defined in the General Conditions on or before the date established for Final Completion in the Owner - Contractor Agreement.

4.3 The following dates shall be adhered to and are the last acceptable dates unless modified in writing by mutual agreement between the Contractor and the Owner. All dates indicate midnight unless otherwise stipulated. The only exceptions to this schedule are defined in the General Conditions under 8.3 DELAYS AND EXTENSIONS OF TIME.

Notice of Intent to Award:	June 16, 2023
Bids to Board of Education:	July 11, 2023
Notice to Proceed: Contract Activities	July 14, 2023
Ph. 1 Constr. Trades Bldg. Notice to Proceed on Site	July 18, 2023
Ph. 2 Int. Renov. Notice to Proceed on Site	December 15, 2023
Ph. 2 Int. Renov. Substantial Completion	March 30, 2024
Ph. 1 Constr. Trades Bldg. Substantial Completion	June 1, 2024
Ph. 1 and Ph. 2 Final Completion:	July 1, 2024

4.4 Should the Contractor fail to complete the Work on or before the dates stipulated for Substantial Completion and/or Final Completion, or such later date as may result from an extension of time granted by the Owner, he shall pay the Owner, as liquidated damages the sums set forth below according to Article 8 of the General Conditions.

Substantial Completion Liquidated Damages:	$300.00 per day
Final Completion Liquidated Damages	$300.00 per day

Article 5

CONTRACT SUM

5.1 Provided that the Contractor shall strictly and completely perform all of its obligations under the Contract Documents, and subject only to additions and deductions by Modification or as otherwise provided in the Contract Documents, the Owner shall pay to the Contractor, in current funds and at the time and in the installments hereinafter specified, the sum of _____ Dollars ($_____) herein referred to as the "Contract Sum". This amount includes the base bid and the Alternates in Section 2.2.

5.2 The Contract Sum includes the value engineering items and other contract modifications noted in Section 2.3 above that total $_____.

5.3 Unit Prices are established as follows for the Project:

Not Used.

Article 6

PROGRESS PAYMENTS

6.1 The Contractor hereby agrees that on or about the Twenty-third day of the month for every month during the performance of the Work he will deliver to the Owner's Project Manager an Application for Payment in accordance with the provisions of Article 9 of the General Conditions. This date may be changed upon mutual agreement, stated in writing, between the Owner and Contractor. Payment under this Contract shall be made as provided in the General Conditions. Payments due and unpaid under the Contract Documents shall not bear interest.

Article 7

OTHER REQUIREMENTS

7.1 The Contractor shall submit the Performance Bond, Labor and Material Payment Bond and Certification of Insurance as required by the Contract Documents.

7.2 The Owner shall furnish to the Contractor one (1) set of hard copy drawings and one (1) hard copy set of specifications, at no extra cost, for use in the Construction of the Work. Additional sets of drawings or specifications may be obtained by the Contractor by paying the Owner for the costs of reproduction, handling and mailing.

7.3 The Contractor shall make a good faith effort to utilize Historically Underutilized Businesses (HUB's) per N.C. Gen. Stat. 143-128.2, and as described in the construction documents.

7.4 The General Conditions, the drawings and specifications, including any addenda, are incorporated herein by reference.

IN WITNESS WHEREOF, New Hanover County Board of Education (hereinbefore called the "Owner") has caused these presents to be signed and its corporate seal to be hereunto affixed, attested by its Chairperson and Secretary, and _____ (hereinbefore called "Contractor") has caused these presents to be signed by its President and its Corporate seal to be hereunto affixed, as hereinafter attested, all as of the day and year first above written.

NEW HANOVER COUNTY BOARD OF EDUCATION

_____
Pete Wildeboer
Chairperson

ATTEST: [Corporate Seal]

_____
Dr. Charles Foust
Superintendent

[CONTRACTOR COMPANY NAME HERE]

_____
(Print Name)
President or Vice-President

ATTEST: [Corporate Seal]

_____
(Print Name)
Corporate Secretary

This instrument has been preaudited in the manner required by the School Budget and Fiscal Control Act.

_____
Ashley Sutton Date
Chief Financial Officer

Bond Forms

PERFORMANCE BOND

IT IS HEREBY AGREED that (Insert full name and address of Contractor) as Principal, hereinafter called Contractor, and (Insert full name and address of Surety) as Surety, hereinafter called Surety, are held and firmly bound unto the

New Hanover County Board of Education
6410 Carolina Beach Road, Wilmingotn NC 28412

as Obligee, hereinafter called Owner, in the amount of _____

_____ Dollars ($), for the payment whereof Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these obligations.

WHEREAS, Contractor has by written agreement dated _____, 2023, entered into a contract with Owner for the construction of SEA-Tech High School SCIF Grant Additions and Renovations in accordance with Drawings and Specifications prepared by Sawyer Sherwood & Associate, P.C. whose address is 124 Market Street, Wilmington, NC 28401, which contract is by reference made a part hereof, and is hereinafter referred to as the Contract.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Contractor shall promptly and faithfully perform said Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect. The Surety hereby waives notice of any alteration or extension of time made by the Owner.

Whenever Contractor shall be, and declared by Owner to be in default, under the Contract, the Owner having performed Owner's obligations thereunder, the Surety may promptly remedy the default, or shall promptly:

1) Complete the Contract in accordance with its terms and conditions, or

2) Obtain a bid or bids for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, or, if the Owner elects, upon determination by the Owner and the Surety jointly of the lowest responsible bidder, arrange for a contract between such bidder and Owner, and make available as Work progresses (even though there should be a default or a succession of defaults under the contract or contracts of completion arranged under this paragraph) sufficient funds to pay the cost of completion less the balance of the contract price; but not exceeding, including other costs and damages for which

the Surety may be liable hereunder, the amount set forth in the first paragraph hereof. The term "balance of the contract price," as used in this paragraph, shall mean the total amount payable by Owner to Contractor under the Contract and any amendments thereto, less the amount properly paid by Owner to Contractor.

Any suit under this bond must be instituted before the expiration of any applicable statute of limitations under the Contract.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the Owner named herein or the heirs, executors, administrators or successors of the Owner.

Signed and sealed this _____ day of _____ 20_____.

PRINCIPAL

[Affix corporate seal]

_____

(Name)_____

(Title)_____

_____

(Witness)

SURETY

[Affix corporate seal]

_____

(Name)_____

(Title)_____

_____

(Witness)

Bond Forms

LABOR AND MATERIAL PAYMENT BOND

THIS BOND IS ISSUED SIMULTANEOUSLY WITH PERFORMANCE BOND IN FAVOR OF THE OWNER CONDITIONED ON THE FULL AND FAITHFUL PERFORMANCE OF THE CONTRACT

IT IS HEREBY AGREED that (Insert full name and address of Contractor) as Principal, hereinafter called "Principal," and (Insert full name and address of Surety) as Surety, hereinafter called "Surety," are held and firmly bound unto the

New Hanover County Board of Education
6410 Carolina Beach Road, Wilmington NC 28412

as Obligee, hereinafter called Owner, for the use and benefit of claimants as herein below defined, in the amount of _____ Dollars ($),

for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these obligations.

WHEREAS, Principal has by written agreement dated _____, 2023, entered into a contract with Owner for the construction of SEA-Tech High School SCIF Grant Additions and Renovations in accordance with Drawings and Specifications prepared by Sawyer Sherwood & Associate, P.C. whose address is 124 Market Street, Wilmington, NC 28401, which contract is by reference made a part hereof, and is hereinafter referred to as the "Contract."

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if Principal shall promptly make payment to all claimants as hereinafter defined, for all labor and material used or reasonably required for use in the performance of the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions:

1. A claimant is defined as one having a direct contract with the principal or with a Subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the Contract, labor and material being construed to include that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental of equipment directly applicable to the Contract.
2. The above named Principal and Surety hereby jointly and severally agree with the Owner that every claimant as herein defined, who has not been paid in full before the expiration of a period of ninety (90) days after the date on which the last of such claimant's work or labor was done or performed, or materials were furnished by such claimant, may sue on this bond for the use of such claimant, prosecute the suit to final judgment for such sum or sums as may be justly due claimant,

and have execution thereon. The Owner shall not be liable for the payment of any costs or expenses of any such suit.

3. No suit or action shall be commenced hereunder by any claimant:

   a) Unless claimant, other than one having a direct contract with the Principal, shall have given written notice to any two of the following: the Principal, the Owner, or the Surety above named, within ninety (90) days, after such claimant did or performed the last of the work or labor, or furnished the last of the materials for which said claim is made, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were furnished, or for whom the work or labor was done or performed. Such notice shall be served by mailing the same by registered mail or certified mail; postage prepaid, in an envelope addressed to the Principal, Owner or Surety, at any place where an office is regularly maintained for the transaction of business, or served in any manner in which legal process may be served in the state in which the aforesaid project is located, save that such service need not be made by a public officer.

   b) After the expiration of one (1) year following the date on which Principal ceased Work on said Contract, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof such limitation shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

   c) Other than in a state court of competent jurisdiction in and for the county or other political subdivision of the state in which the Project, or any part thereof, is situated, or in the United States District Court for the district in which the Project, or any part thereof, is situated, and not elsewhere.

4. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder, inclusive of the payment by Surety of mechanics' liens which may be filed of record against said improvement, whether or not claim for the amount of such lien be presented under and against this bond.

Signed and sealed this _____ day of _____ 2023.

PRINCIPAL

[Affix corporate seal]

_____

(Name)_____

(Title)_____

_____

(Witness)

SURETY

[Affix corporate seal]

_____

(Name)_____

(Title)_____

_____

(Witness)

SECTION IV

MINORITY BUSINESS PARTICIPATION

It is the policy of the Owner to encourage the use of minority businesses in all school construction contracts and to have a verifiable goal of ten percent (10%) participation by minority businesses in the total value of the work. It is the intent of this policy that the Owner, as awarding authority for school construction projects, and all Contractors and Subcontractors performing the construction contracts awarded shall cooperate and in good faith do all things legal, proper, and reasonable to achieve the verifiable goal of ten percent (10%) participation. The Bidder shall make a good faith effort to utilize minority businesses per the requirements of Section I – Information to Bidders.

N.C. Division of Purchasing and Contract's Office for Historically Underutilized Businesses maintains a list of registered companies. Searches can be completed at https://www.ips.state.nc.us/vendor/searchvendor.aspx?t=h . Additionally, the N.C. Interactive Purchasing System is a free online Internet service for companies to do business with the state. The web address is http://www.ips.state.nc.us/ips/ . Questions for the NC office of Historically Underutilized Businesses or IPS should be directed to the help desk (984) 236-0130 or email huboffice.doa@doa.nc.gov .

GENERAL CONDITIONS

NOTICE OF DISCLAIMER

TAKE NOTICE, that these General Conditions may contain language and Article, Section or Paragraph headings or names which appear similar to or the same as the provisions of the "General Conditions of the Contract for Construction", published by the American Institute of Architects, AIA Document A-201.

TAKE NOTICE, however, that these General Conditions are substantially and materially different in many respects from the AIA Document A-201 and that certain additions, deletions or other modifications have been made to provisions similar to those contained in the AIA Document. This document, further, contains provisions, which do not appear in the AIA document.

The use of any language or Article or Paragraph format similar to or the same as AIA Document A-201 does not constitute an endorsement by the American Institute of Architects of this document.

SECTION V
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

TABLE OF ARTICLES

1. CONTRACT DOCUMENTS
2. DESIGN CONSULTANT
3. OWNER
4. CONTRACTOR
5. SUBCONTRACTORS
6. WORK BY OWNER OR BY SEPARATE CONTRACTORS
7. MISCELLANEOUS PROVISIONS
8. TIME
9. PAYMENTS AND COMPLETION
10. PROTECTION OF PERSONS AND PROPERTY
11. INSURANCE
12. CHANGES IN THE WORK
13. UNCOVERING AND CORRECTION
14. TERMINATION OF THE CONTRACT
15. DISPUTE RESOLUTION

APPENDIX A – Contractor's Sales Tax Report
APPENDIX B – Sexual Offender Registry and Criminal Background Check Certification
APPENDIX C – Allowance Expenditure Authorization Form
APPENDIX D-1 – Change Proposal Form (Time & Materials or Unit Price)
APPENDIX D-2 – Change Proposal Form (Fixed Price)

ARTICLE 1

CONTRACT DOCUMENTS

1.1 DEFINITIONS

1.1.1 AS SHOWN, AS INDICATED, AS DETAILED: These words, and words of like implication, refer to information contained in Drawings and Specifications describing the Work, unless explicitly stated otherwise in the Contract Documents.

1.1.2 CLAIM: A Claim as used in the Contract is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of contract terms, payment of money, a credit against the payment of money, extension of time or other relief with respect to the terms of the Contract. The term Claim also includes other disputes and matters in question between the parties to a contract involved in the Owner's construction and repair projects arising out of or relating to the Contract or the construction process.

1.1.3 CONTRACT: The Contract is the sum of all the Contract Documents. The Contract represents the entire and integrated agreement between the Owner and the Contractor and supersedes all prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification as defined in Paragraph 1.1.4. The Contract may also be referred to in the Contract Documents as "this Contract", "this Agreement" or "the Agreement".

1.1.4 CONTRACT DOCUMENTS: The Contract Documents consist of the Owner-Contractor Agreement, the Conditions of the Contract (General Conditions), the Drawings, Specifications, and all Addenda thereto issued prior to and all Modifications thereto issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties; (2) a Change Order or a Construction Change Directive issued pursuant to the provisions of Article 12; (3) a written interpretation issued by the Design Consultant pursuant to Paragraph 2.2.7; or (4) a written order for a minor Change in the Work issued pursuant to Section 12.4. The Contract Documents do not include any other documents including but not limited to soils, geotechnical or other reports, surveys and analysis, which may be printed, bound or assembled with the Contract Documents, or otherwise made available to the Contractor for review or information under this Contract, unless specifically enumerated and directly incorporated by reference in the Contract Documents.

1.1.5 HE/HIS: The term He or His is not intended to be gender specific.

1.1.6 MANUFACTURER: An individual, company, or corporation who manufactures, fabricates, or assembles a standard product. A standard product is one that is not made to special design, and if furnished by either direct sale or by contract to the Contractor, Subcontractor or Vendor.

1.1.7 MATERIAL SUPPLIER OR VENDOR: A person or organization who supplies, but who is not responsible for the installation of, materials, products and equipment.

1.1.8 NOTICE: The term Notice as used herein shall mean and include written notice. Notice shall be deemed to have been given when delivered to the address of the person, firm or corporation for whom intended, or to his, their or its duly authorized agent, representative or officer; or when enclosed in a postage prepaid wrapper or envelope addressed to such person, firm or corporation at his, their or its Notice Address and deposited in a United States mailbox by registered or certified mail. To "Notify" means to give Notice. The Notice Addresses for the Owner and Contractor are stated in the Owner-Contractor Agreement and may be changed by a party by giving Notice to the other of such change.

1.1.9 PLANS OR DRAWINGS: All drawings or reproduction of drawings pertaining to the Work.

1.1.10 PRODUCT: The term Product includes materials, systems and equipment.

1.1.11 PROJECT: The Project is the total construction of which the Work performed under the Contract

Documents may be the whole or a part.

1.1.12 PROPOSAL: A complete and properly signed document whereby the Contractor proposes to provide additional or a reduced scope of construction work on the Project for the sums stipulated therein, supported by data required by the Design Consultant or Owner.

1.1.13 PROVIDE: As a directive to the Contractor, and as pertaining to labor, materials or equipment, "provide" means "furnish and install completely".

1.1.14 SPECIFICATIONS: Descriptions, provisions and requirements, pertaining to method and manner of performing the Work, or to quantities and qualities of materials or equipment to be furnished under terms of the Contract.

1.1.15 WORK: The Work comprises the construction and services required of the Contractor by the Contract Documents and includes all labor, supplies and other facilities or things necessary to produce such construction, and all materials, equipment, and supplies incorporated or to be incorporated in such construction.

1.2 EXECUTION, CORRELATION AND INTENT

1.2.1 The Contractor and Owner acknowledge that neither these General Conditions, nor any other Contract Document shall be construed against the Owner due to the fact that they may have been drafted by the Owner or the Owner's agent. For the purposes of construing these General Conditions, and any other Contract Document, both the Contractor and the Owner shall be considered to have jointly drafted them.

1.2.2 The Owner-Contractor Agreement shall be signed in not less than three (3) copies by the Owner and Contractor, and each of which shall be deemed an original, but all of which shall constitute one and the same instrument.

1.2.3 By executing the Contract, the Contractor represents that he has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents.

1.2.4 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work. The Contract Documents are complementary, and what is required by any one shall be as binding as if required by all. Performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results. Words and abbreviations which have well-known technical or trade meanings are used in the Contract Documents in accordance with such recognized meanings unless otherwise specifically defined herein. The table of contents, titles, headings, running headlines and marginal notes contained herein and in said documents are solely to facilitate reference to various provisions of the Contract Documents and in no way affect, limit or cast light upon the interpretation of the provisions to which they refer.

1.2.5 The organization of the Specifications into divisions, sections and articles, and the arrangement of Drawings are for convenience only. The Contractor may subcontract the Work in such divisions as he sees fit consistent with applicable law and he is ultimately responsible for furnishing all of the Work.

1.2.6 Anything shown on the Drawings and not mentioned in the Specifications or mentioned in the

Specifications and not shown on the Drawings shall have the same effect as if shown or mentioned respectively in both. Detailed specifications take priority over general specifications and detailed drawings take precedence over general drawings. Any Work shown on one drawing shall be construed to be shown in all drawings. If any portion of the Contract Documents shall be in conflict with any other portion, the various documents comprising the Contract Documents shall govern in the following order of precedence: The Owner-Contractor Agreement; the General Conditions; the Specifications; the Drawings. The Contractor shall notify the Design Consultant and the Owner of all such inconsistencies promptly. Any such conflict or inconsistency between or in the Drawings or Specifications shall be submitted by the Contractor promptly to the Owner and Design Consultant and the Design Consultant's decision thereon shall be final and conclusive.

1.2.7 The Contractor agrees that nothing contained in the Contract Documents or any contract between the Owner and the Design Consultant shall create any contractual relationship between the Design Consultant and the Contractor, or between the Design Consultant and any Subcontractor or Sub-subcontractors. The Contractor acknowledges and agrees that this Contract is not intended to create, nor shall any provision be interpreted as creating, any contractual relationship between the Owner or Contractor and any third parties.

1.2.8 The provisions of this Contract cannot be amended, modified, varied or waived in any respect except by a Modification. The Contractor is hereby given notice that no person has authority to orally waive, or to release the Contractor from any of the Contractor's duties or obligations under or arising out of this Contract. Any waiver, approval or consent granted by Modification to the Contractor shall be limited to those matters specifically and expressly stated thereby to be waived, approved or consented to and shall not relieve the Contractor of the obligation to obtain any future waiver, approval or consent.

1.2.9 Any material or operation specified by reference to published specifications of a Manufacturer, a society, an association, a code, or other published standard, shall comply with requirements of the listed document which is current on date the Owner received bids for the construction of the Project. In case of a conflict between referenced document and the Specifications, Specifications shall govern. In case of a conflict between such listed documents, the one having more stringent requirements shall govern.

1.2.10 The Contractor, if requested, shall furnish an affidavit from each or any Manufacturer certifying that materials or products delivered to the job meets requirements specified.

1.3 OWNERSHIP AND USE OF DOCUMENTS

1.3.1 All Drawings, Specifications and copies thereof furnished by the Design Consultant are and shall remain the property of the Owner. They are to be used by Contractor only with respect to the Project and are not to be used by Contractor on any other project. With the exception of one contract set for each party to the Contract, such documents are to be returned or suitably accounted for to the Owner on request at the completion of the Work. Submission or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of Owner's rights or the Design Consultant's common law copyright or other reserved rights.

ARTICLE 2

THE DESIGN CONSULTANT

2.1 DEFINITIONS

2.1.1 The term "Design Consultant" or "A/E" or "Architect" or "Engineer" as used or set forth in the Contract Documents, shall mean the entity and its consultants or agents, or their duly authorized representatives, that is responsible for designing or engineering the Work, and performing the activities specified herein, and in the Agreement for Design Consultant Services, including any consultants to said entity or firm acting within the scope of their agreements with the Design Consultant. Such firm or agency and its representatives shall act severally within the scope of particular duties entrusted to them, unless otherwise provided for in the Contract Documents or in the Agreement for Design Consultant Services.

2.1.2 The Design Consultant may be identified in the Owner-Contractor Agreement and is referred to throughout the Contract Documents as if singular in number and masculine in gender. The Design Consultant is further described as and, throughout this document, shall mean one or both of the following:

2.1.2.1 ARCHITECT, a person or other legal entity lawfully licensed to practice architecture in the State wherein the Project is located; or

2.1.2.2 ENGINEER, a person or other legal entity lawfully licensed to practice engineering in the State wherein the Project is located.

2.2 SERVICES OF THE DESIGN CONSULTANT

2.2.1 The Design Consultant will provide certain services as hereinafter described and further described in the Agreement for Design Consultant Services.

2.2.2 Should errors, omissions, or conflicts in the Drawings, Specifications, or other Contract Documents prepared by or on behalf of the Design Consultant be discovered, the Design Consultant will prepare such amendments or supplementary documents and provide consultation as may be required.

2.2.3 The Design Consultant will visit the site at intervals appropriate to the stage of construction to familiarize itself generally with the progress and quality of the Work and to determine in general if the Work is proceeding in accordance with the Contract Documents. The Design Consultant will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work, but it shall make as many inspections as may reasonably be required to fulfill its obligations to the Owner. On the basis of such on-site observations, the Design Consultant and his consultants shall endeavour to guard the Owner against defects and deficiencies in the Work. The Design Consultant will conduct the weekly construction meeting and shall be responsible for preparing accurate and complete minutes of all such meetings and other Project meetings and distributing same to all participants.

2.2.4 The Design Consultant will render written field reports to the Owner in the form required by the Owner relating to the periodic visits and inspections of the Project required by Paragraph 2.2.3.

2.2.5 The Design Consultant will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and he will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Design Consultant will not be responsible for or have control or charge over the acts or omissions of the Contractor, Subcontractors, or any of their agents or employees, or any other persons performing any portion of the Work.

2.2.6 The Design Consultant shall at all times have access to the Work wherever it is in preparation or progress. The Contractor shall provide safe facilities for such access so the Design Consultant may perform his functions under the Contract Documents.

2.2.7 As required, the Design Consultant will render to the Owner, within a reasonable time, interpretations concerning the design and other technical aspects of the Work and the Contract Documents.

2.2.8 All communications, correspondence, submittals, and documents exchanged between the Design Consultant and the Contractor in connection with the Project shall be through the Owner or in the manner prescribed by the Owner. Further, all communications, correspondence, submittals and documents transmitted from the Owner or Design Consultant will be directed to the Contractor and copied to the Owner or Design Consultant.

2.2.9 All interpretations and decisions of the Design Consultant shall be consistent with the intent of and reasonably inferable from the Contract Documents.

2.2.10 The Design Consultant's decisions in matters relating to artistic effect will be final if consistent with the intent of the Contract Documents.

2.2.11 If the Design Consultant observes any Work that does not conform to the Contract Documents, the Design Consultant shall report this observation to the Owner. The Design Consultant will prepare and submit to the Owner "punch lists" of the Contractor's work, which is not in conformance with the Contract Documents. The Owner will transmit such "punch lists" to the Contractor.

2.2.12 The Design Consultant has the authority to condemn or reject any or all of the Work on behalf of the Owner when, in its opinion, the Work does not conform to the Contract Documents. Whenever, in the Design Consultant's reasonable opinion, it is considered necessary or advisable for the implementation of the intent of the Contract Documents, the Design Consultant will have the authority to require special inspection or testing of any portion of the Work in accordance with the provisions of the Contract Documents whether or not such portion of the Work be then fabricated, installed or completed.

2.2.13 The Design Consultant will review the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for conformance with the design concept of the Work and for general compliance with the Contract Documents. Such action shall be taken within fourteen (14) days of receipt unless otherwise authorized by the Owner.

2.2.14 The Owner will establish with the Design Consultant procedures to be followed for review and processing of all Shop Drawings, catalogue submittals, project reports, test reports, maintenance manuals, and other necessary documentation, as well as requests for changes and applications for extensions of time.

2.2.15 The Design Consultant will prepare Change Orders and Construction Change Directives when requested by the Owner.

2.2.16 The Design Consultant and the Owner will conduct inspections to determine the dates of Substantial Completion and Final Completion. The Design Consultant will issue a final Certification of Payment.

2.2.17 The Design Consultant will prepare three (3) printed copies and one (1) electronic computer file compatible with the latest version of AutoCAD, or other program designated by Owner, showing significant Changes in the Work made during the construction process, based on neatly and clearly marked-up Drawings, prints, and other data furnished by the Contractor(s) and the applicable Addenda, clarifications and Change Orders which occurred during the Project. The Design Consultant will also provide the Owner assistance in the original operation of any equipment or system such as initial start-up, testing, adjusting, and balancing.

2.2.18 In case of the termination of the employment of the Design Consultant, the Owner may appoint a Design Consultant whose status under the Contract Documents shall be that of the former Design Consultant.

ARTICLE 3

OWNER

3.1 DEFINITION

3.1.1 The Owner is the person or entity identified as such in the Owner-Contractor Agreement and may be referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Owner means the Owner or his authorized representative or agent. The phrase "Owner or its agent" as used in this Agreement, does not include the Separate Contractors or their Subcontractors.

3.1.2 Owner: New Hanover County Board of Education
6410 Carolina Beach Road
Wilmington, North Carolina, 28412

3.2 INFORMATION, SERVICES AND RIGHTS OF THE OWNER

3.2.1 The Owner will provide administration of the Contract as herein described. The Design Consultant shall also provide aspects of administration of the Contract as herein described or as specified in the Agreement for Design Consultant Services.

3.2.2 The Owner shall at all times have access to the Work whenever it is in preparation or progress. The Contractor shall provide safe facilities for such access.

3.2.3 The Owner shall not be responsible for or have control or charge of the construction means, methods, techniques, sequences, or procedures, or for safety precautions and programs in connection with the Work, and will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents.

3.2.4 The Owner will have authority to require special inspection or testing of portions of the Work to the same extent as the Design Consultant in accordance with Paragraph 2.2.12 whether or not

such portion of the Work be then fabricated, installed, or completed. However, neither the Owner's authority to act under Paragraph 3.2.4, nor any decision made by the Owner in good faith either to exercise or not to exercise such authority shall give rise to any duty or responsibility of the Owner to the Contractor, any Subcontractor, any of their agents or employees, or any other person performing any of the Work.

3.2.5 The Owner shall have the authority and discretion to call, schedule, and conduct job meetings to be attended by the Contractor, representatives of his Subcontractors, and the Design Consultant, to discuss such matters as procedures, progress, problems, and scheduling.

3.2.5.1 The Contractor is requested and required to attend weekly job site progress conferences as called by the Design Consultant. The Contractor shall be represented at these job progress conferences by project personnel authorized by the Contractor to make schedule and financial decisions and by project personnel representatives. These meetings shall be open to Subcontractors, Material Suppliers, and any others who can contribute shall be encouraged by the Contractor to attend. It shall be the principal purpose of these meetings, or conferences, to affect coordination, cooperation and assistance in every practical way toward the end of maintaining progress of the Project on schedule and to complete the Project within the specified Contract Time. The Contractor shall be prepared to assist progress of the Work as required in his particular contract and to recommend remedial measures for the correction of progress as may be appropriate. The Design Consultant shall be the coordinator of the conferences and shall preside as chairman.

3.2.5.2 If the Project is awarded as a single prime construction contract, the Design Consultant shall determine which, if any, Subcontractors and/or Material Suppliers shall be required to attend weekly job site progress conferences. The Contractor shall comply with this request and the meeting shall be conducted as described in Subparagraph 3.2.5.1.

3.2.6 The Owner will establish procedures to be followed for processing all Shop Drawings, catalogues, and other project reports, and other documentation, test reports, and maintenance manuals.

3.2.7 The Owner and Design Consultant will review all requests for changes and shall implement the processing of Change Orders, including applications for extension of the Contract Time.

3.2.8 The Owner, will not be responsible for the failure of the Contractor to plan, schedule, and execute the Work in accordance with the approved schedule or the failure of the Contractor to meet scheduled Completion Dates or the failure of the Contractor to schedule and coordinate the Work of his own trades and Subcontractors or to coordinate and cooperate with any Separate Contractors.

3.2.9 The Owner, in consultation with the Design Consultant, will review and process all Applications for Payment by the Contractor, including the final Application for Payment.

3.2.10 The Owner and Design Consultant shall not be responsible or liable to Contractor for the acts, errors or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons performing any of the Work or working on the Project.

3.2.11 The Owner shall furnish surveys describing the physical characteristics and legal limitations for the site of the Project, which are in its possession and are relevant to the Work.

3.2.12 The Owner shall secure and pay for necessary easements, required for permanent structures or for permanent changes in existing facilities.

3.2.13 The Owner shall furnish information or services under the Owner's control with reasonable promptness to avoid unreasonable delay in the orderly progress of the Work.

3.2.14 Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, one (1) hard copy of Drawings and one (1) hard copy Specifications in accordance with the Owner- Contractor Agreement.

3.2.15 The Owner will make reasonable efforts to make available for the Contractor's reasonable review, at the Owner's offices or together with the Contract Documents, certain boring logs, geotechnical, soils and other reports, surveys and analyses pertaining to the Project site of which the Owner is aware, has in its possession and are relevant to the Work. Any boring logs that are provided to the Contractor are only intended to reflect conditions at the locations of the borings and do not necessarily reflect site conditions at other locations. Any reports, surveys and analyses provided by Owner are for the Contractor's information only, and their accuracy and completeness are not guaranteed or warranted by the Owner or the Design Consultant, and such reports are not adopted by reference into, nor are they part of the Contract Documents. Notwithstanding any factual statement, conclusion, or any language or recommendations contained in such reports, the Contractor shall not rely upon the accuracy or completeness of any reports, surveys and analyses.

3.2.16 The foregoing rights are in addition to other rights of the Owner enumerated herein and those provided by law.

3.3 OWNER'S RIGHT TO STOP OR TO SUSPEND THE WORK

3.3.1 If the Contractor fails to correct defective Work as required by Section 13.2 or fails to carry out the Work or supply labor and materials in accordance with the Contract Documents, the Owner by a written Notice may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of the Owner to stop the Work shall not give rise to any duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity.

3.3.2 The Owner may order the Contractor in writing to suspend, delay, or interrupt all or any part of the Work for such period of time as he may determine to be appropriate for the convenience of the Owner.

3.3.3 If the performance of all or any part of the Work (including the work of the Contractor and its Subcontractors) is, for an unreasonable period of time, suspended, delayed, or interrupted by an act of the Owner or the Design Consultant , or by failure of any one of them to act within the time specified in this Contract (or if no time is specified, within a reasonable time), an adjustment shall be made for an increase in the actual time required for performance of the Work by the Contractor, due solely to such unreasonable suspension, delay, or interruption and the Contract modified in writing accordingly. However, no Claim shall be made under this Paragraph for any suspension, delay, or interruption pursuant to Paragraph 3.4.1, or for which Claim is provided or excluded under any other provision of this Contract. No Claim under this Paragraph shall be allowed on behalf of the Contractor or its Subcontractors, unless within twenty (20) days after the act or failure to act involved, and for continuing or ongoing acts or failures to act within twenty (20) days of the first day of the act or failure to act, the Contractor submits to the Owner a written statement setting forth, as fully as then practicable, the extent of

such Claim, and unless the Claim is asserted in writing within thirty (30) days after the termination of such suspension, delay, or interruption. For continuing or ongoing acts or failures to act, the Contractor shall update its written statement every twenty (20) days until the suspension, delay or interruption is terminated. The Contractor shall waive any and all Claims under this Paragraph 3.3.3 which are not filed in strict conformance with Paragraph 3.3.3. The Contractor shall indemnify, defend and hold the Owner harmless from any Claim by a Subcontractor that is waived because it is not filed in strict conformance with this Paragraph 3.3.3 or any other provision of the Contact regarding Claims.

3.3.4 In the event of a suspension of the Work or delay or interruption of the Work per Paragraph 3.3.3, the Contractor will and will cause his Subcontractors to protect carefully his, and their, materials and Work against damage, loss or injury from the weather and maintain completed and uncompleted portions of the Work as required by the Contract Documents. If, in the opinion of the Owner, any Work or material shall have been damaged or injured by reason of failure on the part of the Contractor or any of his Subcontractors to so protect same, such Work and materials shall be removed and replaced at the expense of the Contractor.

3.3.5 No Claim by the Contractor under Paragraph 3.3.3 shall be allowed if asserted after final payment under this Contract or if it is not asserted in strict conformance with Paragraph 3.3.3.

3.4 OWNER'S RIGHT TO CARRY OUT THE WORK

3.4.1 If the Contractor defaults or otherwise neglects to carry out the Work in accordance with the Contract Documents and fails within ten (10) days after the date written Notice is given by the Owner, with a copy of such Notice sent to the Contractor's Surety, to commence and continue remedy of such default or neglect with diligence and promptness, the Owner may, without prejudice to any other remedy he may have, make good such deficiencies and may further elect to complete all Work thereafter through such means as the Owner may select, including the use of a new contractor pursuant to Paragraph 3.4.2. In such case, the Owner shall provide Notice to the Contractor's Surety and an appropriate Change Order shall be issued deducting from the payments then or thereafter due the Contractor the cost of correcting such deficiencies, including compensation for the Design Consultant's additional services made necessary by such default, neglect or failure and any other damages suffered by Owner as a result of Contractor’s breach, including but not limited to Owner’s reasonable attorney’s fees and litigation costs and expenses. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor or its Surety shall pay the difference to the Owner. Notwithstanding the Owner's right to carry out a portion of the Work, warranty, maintenance and protection of the Work remains the Contractor's and Surety's responsibility. Further, the provisions of this Paragraph do not affect the Owner's right to require the correction of defective or non-conforming Work in accordance with Section 13.2.

3.4.2 Whenever the Contractor shall be, and declared by the Owner to be in default under the Contract, the Owner having substantially performed Owner's obligations thereunder, the Surety shall promptly remedy the default, or shall be liable to Owner for damages pursuant to the Performance Bond and as provided by law. Any action by Surety or by Owner against the Surety shall not relieve Contractor of its duties, responsibilities and liabilities to Owner pursuant to the Contract or as allowed by law.

ARTICLE 4

CONTRACTOR

4.1 DEFINITION

4.1.1 The Contractor is the person or organization identified as such in the Owner-Contractor Agreement and may be referred to throughout the Contract Documents as if singular in number and masculine in gender. The term Contractor means the Contractor or his authorized representative, who shall have authority to bind the Contractor in all matters pertinent to the Contract.

4.1.2 The Contract is not one of agency by the Contractor for Owner but one in which Contractor is engaged independently in the business of providing the services and performing the Work herein described as an independent contractor.

4.2 REVIEW OF CONTRACT DOCUMENTS

4.2.1 The Contractor represents that prior to executing this Contract, the Contractor carefully reviewed and studied the Contract Documents and notified the Owner and Design Consultant of any errors, inconsistencies or omissions of which the Contractor is aware. The Contractor agrees to continuously and carefully study and compare the Contract Documents after the execution of this Contract and shall at once report to the Owner and Design Consultant any error, inconsistency or omission he may discover, including, but not limited to, any requirement which may be contrary to any law, ordinance, rule, regulation, building code, or order of any public authority bearing on the Work. If the Contractor has reported in writing an error, inconsistency or omission, has promptly stopped the affected Work until otherwise instructed, and has otherwise followed the instructions of the Owner, the Contractor shall not be liable to the Owner or the Design Consultant for any damage resulting from any such errors, inconsistencies or omissions in the Contract Documents. The Contractor shall perform no portion of the Work at any time without it being specified in Contract Documents and, where required, approved Shop Drawings, Product Data or Samples for such portion of the Work.

4.2.2 The Contractor and his Subcontractors shall keep at the site of the Work at least one copy of the Drawings and Specifications and shall at all times give the Owner, the Design Consultant, inspectors, as well as other representatives of the Owner access thereto.

4.3 SUPERVISION AND CONSTRUCTION PROCEDURES

4.3.1 The Contractor shall supervise and direct the Work, using his best skill and attention. He shall be solely responsible for and have control over all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract.

4.3.1.1 It shall be the Contractor's responsibility to schedule the Work; to maintain a progress schedule for the Project; and to notify the Design Consultant and the Owner of any changes in the progress schedule. He shall be responsible for providing adequate notice to all Subcontractors to insure efficient continuity of all phases of the Project. The Contractor is responsible for keeping the Owner and Design Consultant fully informed as to the work progress, including immediate notification of any work progress changes.

4.3.2 The Contractor shall be responsible to the Owner for the acts and omissions of his employees,

Subcontractors and Sub-subcontractors, Suppliers, their agents and employees, and other persons performing any of the Work and for their compliance with each and every requirement of the Contract Documents, in the same manner as if they were directly contracted by the Contractor.

4.3.3 The Contractor shall not be relieved from his obligations to perform the Work in accordance with the Contract Documents either by the acts, failures to act or duties of the Owner or the Design Consultant in their administration of the Contract, or by inspections, tests or approvals (or the lack thereof) required or performed under Section 7.6 by persons other than the Contractor.

4.3.4 Before starting a section of the Work, the Contractor shall carefully examine all preparatory work that has been executed to receive his work to see that it has been completed in accordance with the Contract Documents. He shall check carefully, by whatever means are required, to ensure that his work and adjacent, related work will finish to proper and required standards for quality, contours, planes, and levels.

4.3.5 The Contractor understands and agrees that the Owner and Design Consultant will not be responsible for and will not have control or charge of construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, and they will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Owner and the Design Consultant will not be responsible for or have control or charge over the acts or omissions of the Contractor, Subcontractors, or any of their agents or employees, or any other persons performing any of the Work.

4.3.6 The Contractor shall not use or provide Subcontractor equipment, materials, methods or persons to which Owner and Design Consultant have a reasonable objection and shall remove no portion of the Work or stored materials from the site of the Work, except for defective Work the Contractor may be required to replace or repair as set forth herein.

4.3.7 The Contractor shall verify all grades, lines, levels and dimensions as indicated and shown on the Drawings and in the Specifications prior to beginning any portion of the Work and shall immediately report in writing any errors or inconsistencies to the Design Consultant before commencing that portion of the Work.

4.4. CONTRACTOR'S REPRESENTATIONS

4.4.1 By entering into this Contract with the Owner, the Contractor represents and warrants the following, together with all other representations and warranties in the Contract Documents:

.1 That he is experienced in and competent to perform the type of work required and to furnish the Subcontractors, materials, supplies, equipment and services to be performed or furnished by him;

.2 That he is financially solvent, able to pay his debts as they mature, and possessed of sufficient working capital to initiate and complete the Work required under the Contract;

.3 That he is familiar with all Federal, State, County, municipal and department laws, ordinances, permits, regulations, building codes and resolutions which may in any way affect the Work or those employed therein, including but not limited to any special laws or regulations relating to the Work or any part thereof;

.4 That such temporary and permanent Work required by the Contract Documents will be satisfactorily constructed and fit for use for its intended purpose and that such construction will not injure any person, or damage any property;

.5 That he has carefully examined the Contract Documents and the site of the Work and that from his own investigations, he has satisfied himself and made himself familiar with: (1) the nature and location of the Work; (2) the character, quality and quantity of surface and subsurface materials likely to be encountered, including, but not limited to, all structures and obstructions on or at the Project site, both natural and man-made; (3) the character of equipment and other facilities needed for the performance of the Work; (4) the general and local conditions including without limitation its climatic conditions, the availability and cost of labor and the availability and cost of materials, tools and equipment; (5) the quality and quantity of all materials, supplies, tools, equipment, labor and professional services necessary to complete the Work in the manner required by the Contract Documents; and (6) all other matters or things which could in any manner affect the performance of the Work;

.6 That he will fully comply with all requirements of the Contract Documents;

.7 That he will perform the Work consistent with good workmanship, sound business practice, and in the most expeditious and economical manner consistent with the best interests of the Owner;

.8 That he will furnish efficient business administration and experienced project management and supervision, and an adequate supply of workers, equipment, tools and materials at all times;

.9 That he has carefully reviewed the Work required and that the Work can be planned and executed in a normal and orderly sequence of Work and reasonably scheduled so as to ensure completion of the Work in accordance with the Contract Documents, allowing for normal and reasonably foreseeable weather, labor and other delays, interruptions and disruptions of the Work;

.10 That he will complete the Work within the Contract Time and all portions thereof within any required Completion Dates;

.11 That his Contract Sum is based upon the labor, materials, systems and equipment required by the Contract Documents, without exception; and

.12 That he will make a good faith effort to utilize minority and Historically Underutilized Businesses (HUBs) as defined and required in N.C. Gen. Stat. 143-128.2 to -128.4, and as described in the Contract documents.

4.5 LABOR AND MATERIALS

4.5.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, materials, equipment, supplies, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary or proper for or incidental to the execution and completion of the Work required by and in accordance with the Contract Documents and any applicable code or statute, whether specifically required by the Contract Documents or whether their provision may reasonably be inferred as necessary to produce the intended results, whether temporary or permanent and whether or not incorporated

or to be incorporated in the Work. Final payment will not be made until the Work is so completed and Contractor has otherwise complied with the Contract Documents in full.

4.5.2 The Contractor shall at all times enforce strict discipline and good order among his employees and Subcontractors performing any of the Work and shall not employ or contract with on the Work any unfit person or entity or anyone not skilled in the task assigned to him. The Owner may, by Notice, require the Contractor to remove from the Work any employee or employee of a Subcontractor performing any of the Work, that the Owner deems incompetent, careless or otherwise objectionable.

4.5.3 The Contractor shall be responsible for ensuring that the Work is completed in a skilful and workmanlike manner.

4.5.4 All equipment, apparatus and/or devices of any kind to be incorporated into the Work that are shown or indicated on the Drawings or called for in the Specifications or required for the completion of the Work shall be entirely satisfactory to the Owner and the Design Consultant as regards operations, capacity and/or performance. No approval, either written or verbal, of any drawings, descriptive data or samples of such equipment, apparatus and/or device shall relieve the Contractor of his responsibility to turn over the same in good working order for its intended purpose at the completion of the Work in complete accordance with the Contract Documents. Any equipment, apparatus and/or device not fulfilling these requirements shall be removed and replaced by proper and acceptable equipment, etc. or put in good working order satisfactory to the Owner and Design Consultant without additional cost to the Owner.

4.6 WARRANTY

4.6.1 The Contractor warrants to the Owner and the Design Consultant that all materials and equipment furnished under this Contract will be new unless otherwise specified, and that all workmanship will be in accordance with generally accepted industry standards, free from faults and defects and in conformance with the Contract Documents and all other warranties and guaranties specified therein. Where no standard is specified for such workmanship or materials, they shall be the best of their respective kinds. All Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. If required by the Owner or the Design Consultant, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This warranty is not limited by the provisions of Article 13.

4.6.2 The Contractor will be required to complete the Work specified and to provide all items needed for construction of the Project, complete and in good order.

4.6.3 The warranties set forth in this Section 4.6 and elsewhere in the Contract Documents shall survive Final Completion of the Work under Section 9.9.

4.6.4 The Contractor guarantees and warrants to the Owner all Work as follows:

.1 That all materials and equipment furnished under this Contract will be new and the best of its respective kind unless otherwise specified;

.2 That all Work will be in accordance with generally accepted industry standards and free of omissions and faulty, poor quality, imperfect and defective material or workmanship;

.3 That the Work shall be entirely watertight and leak proof in accordance with all applicable

industry customs and practices, and shall be free of shrinkage and settlement;

.4 That the Work, including but not limited to, mechanical and electrical machines, devices and equipment, shall be fit and fully usable for its intended and specified purpose and shall operate satisfactorily with ordinary care;

.5 That consistent with requirements of the Contract Documents, the Work shall be installed and oriented in such a manner as to facilitate unrestricted access for the operation and maintenance of fixed equipment;

.6 That the Work will be free of abnormal or unusual deterioration which occurs because of poor quality materials, workmanship or unsuitable storage; and

.7 That the products or materials incorporated in the Work will not contain asbestos.

4.6.5 All Work not conforming to guarantees and warranties specified in the Contract Documents, including substitutions not properly approved and authorized, may be considered defective. If required by the Design Consultant or Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

4.6.5.1 The Contractor will submit a written affidavit certifying that none of the materials incorporated in the Project contain asbestos.

4.6.6 If, within one (1) year after the date of Substantial Completion of the Work or designated portion thereof as defined in Paragraph 8.1.3 or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be defective, not in accordance with the Contract Documents, or not in accordance with the guarantees and warranties specified in the Contract Documents, the Contractor shall correct it within five (5) working days or such other period as mutually agreed, after receipt of Notice from the Owner to do so. The Owner shall give such Notice with reasonable promptness after discovery of the condition. For items that remain incomplete or uncorrected on the date of Substantial Completion, the one (1) year warranty shall begin on the date of Final Completion of the Work or upon correction of the defective Work. If the Contract Documents include painting work, the one year warranty period in this section shall be extended to two years for the painting scope.

4.6.7 If at any time deficiencies in the Work are discovered which are found to have resulted from fraud or misrepresentation, or an intent or attempt to or conspiracy to defraud the Owner by the Contractor, any Subcontractor or Supplier, the Contractor will be liable for replacement or correction of such Work and any damages which Owner has incurred related thereto, regardless of the time limit of any guarantee or warranty.

4.6.8 Any materials or other portions of the Work, installed, furnished or stored on site which are not of the character or quality required by the Specifications, or are otherwise not acceptable to the Design Consultant or the Owner, shall be immediately removed and replaced by the Contractor to the satisfaction of the Design Consultant and Owner, when notified to do so by the Design Consultant or Owner.

4.6.9 If the Contractor fails to correct defective or non-conforming Work as required by Paragraph 4.6.6, or if the Contractor fails to remove defective or non-conforming Work from the site, as required by Paragraph 4.6.8, the Owner may elect to either correct such Work in accordance with Section 3.4 or remove and store materials and equipment at the expense of the Contractor. If the Contractor does not pay the cost of such removal and storage within ten (10) days thereafter, the Owner may upon ten (10) additional days written Notice sell such Work at auction or at private sale and shall account for the net proceeds thereof, after deducting all the costs that should have been borne by the Contractor, including compensation for the Design Consultant's additional services and Owner's reasonable attorney's fees made necessary thereby. If such proceeds of sale do not cover all costs, which the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate Change Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

4.6.10 The Contractor shall bear the cost of making good all of the Work of the Owner, Separate Contractors or others, destroyed or damaged by such correction or removal required under this Article 4, Article 13 or elsewhere in the Contract Documents.

4.7 TAXES

4.7.1 The Contractor shall pay all sales, consumer, use and other similar taxes for the Work or portions thereof provided by the Contractor which are legally enacted at the time the Owner received bids for the construction of the Project, whether or not yet effective.

4.7.2 Sales and Use Tax. Contractor shall be responsible for complying with any applicable sales and use tax obligations imposed by Chapter 105, Article 5 of the North Carolina General Statutes. Where Contractor has been contracted with to oversee "new construction" or "reconstruction" as defined in G.S. 105-164.4H, Contractor shall be responsible for issuing and maintaining an Affidavit of Capital Improvement.

4.8 PERMITS, FEES AND NOTICES

4.8.1 The Owner shall be responsible for fees associated with permits and approval of the Drawings including but not limited to building permit, utility impact fees, stormwater permit and driveway permit.

4.8.2 The Contractor is responsible for all fees, permits and other costs associated with temporary utilities, including but not limited to installation, use, disconnection, removal and/or relocation.

4.8.3 The Contractor will pay for his own license, inspection and re-inspection fees for the proper execution and completion of the Work.

4.8.4 The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work, including but not limited to all applicable building codes. If Contractor believes that any part of the Drawings or Specifications are inconsistent with applicable laws, rules, regulations, lawful orders of public authorities or building codes, Contractor shall Notify the Owner and Design Consultant of such inconsistencies immediately.

4.9 ALLOWANCES

4.9.1 The Contractor shall include in the Contract Sum all Allowances stated in the Contract Documents. Items covered by these Allowances shall be supplied for such amount and by such persons as the Owner may direct, but the Contractor will not be required to employ persons against whom he makes a reasonable objection.

4.9.2 Unless otherwise provided in the Contract Documents:

.1 Allowances for Work: These allowances shall cover the cost to the Contractor for the materials and equipment required by the allowance delivered at the site, all applicable taxes, unloading, uncrating and storage, protection from elements, labor, installation and finishing and other expenses and time required to complete the installation, and a fixed percentage for overhead and profit as defined in Article 12.

.2 Allowances for Products/Materials: Allowance includes the cost of the product, delivery to the site and applicable taxes. The Contractor's costs for unloading and handling on the site, labor, installation, time, overhead, profit and other expenses contemplated for the material allowance shall be included in the Contract Sum and not in the allowance;

.3 Whenever the cost is more than or less than the Allowance, the Contract Sum shall be adjusted accordingly by Change Order, the amount of which will recognize changes, if any, in handling costs on the site, labor, installation costs, overhead, profit and other expense.

4.10 SUPERINTENDENT

4.10.1 The Contractor shall employ, and have approved by the Owner, a competent superintendent and necessary assistants who shall be in attendance at the Project site during the progress of the Work. The superintendent shall represent the Contractor and all communications given to the superintendent shall be as binding as if given to the Contractor. If the Contractor employs more than a single individual in this role, the Owner shall be provided an organizational chart and personnel listing for the staff performing the functions of a superintendent. In such event, all references to the superintendent elsewhere in the Contract Documents shall mean the staff performing the functions of a superintendent.

4.10.2 The superintendent shall be in attendance at the Project site not less than eight (8) hours per day, five (5) days per week, unless the job is closed down due to conditions beyond the control of the Contractor or until termination of the Contract in accordance with the Contract Documents. It is understood that such superintendent shall be acceptable to the Owner and shall be the one who will be continued in that capacity for the duration of the Project, unless he ceases to be on the Contractor's payroll or the Owner otherwise agrees. The superintendent shall not be employed on any other project for or by Contractor or any other entity during the course of the Work.

4.11 PROGRESS SCHEDULE

4.11.1 The Contractor shall prepare and submit to the Owner for the Owner's review and approval an estimated progress schedule for the Work pursuant to the Specifications sections for construction schedules.

4.12 RESPONSIBILITY FOR COMPLETION

4.12.1 The Contractor shall furnish such manpower, materials, facilities and equipment and shall work within the normal scheduled working hours to ensure the performance of the Work within the

Completion Dates specified in the Owner-Contractor Agreement. If for any reason the Contractor must work outside of the normal scheduled working hours, a custodian employed by the Owner is required to be in attendance when accessing the work area. The Contractor agrees to reimburse the Owner at a rate of thirty five dollars ($35.00) per hour for such custodian's time. The reimbursement is due with the subsequent payment application.

4.12.2 If it becomes apparent to the Design Consultant or Owner that the Work will not be completed within required Completion Dates, the Contractor agrees to undertake some or all of the following actions, at no additional cost to the Owner, in order to ensure, in the opinion of the Design Consultant and Owner, that the Contractor will comply with all Completion Date requirements:

.1 Increase manpower, materials, crafts, equipment and facilities;

.2 Increase the number of working hours per shift, shifts per working day, working days per week, or any combination of the foregoing, including but not limited to night shifts, overtime operations and Sundays and holidays;

.3 Reschedule activities to achieve maximum practical concurrence of accomplishment of activities;

.4 Require that his superintendent be at the Project site not less than ten (10) hours per day, six (6) days per week; and

.5 Reimburse the Owner in accordance with Paragraph 4.12.1 above for all work performed outside of the normal scheduled work hours.

4.12.3 In undertaking the actions required under Paragraph 4.12.1, Contractor shall comply with the requirements for a recovery schedule set forth in the Specifications sections for construction schedules.

4.12.4 If the actions taken by the Contractor are not satisfactory, the Design Consultant or Owner may direct the Contractor to take any and all actions necessary to ensure completion within the required Completion Dates, without additional cost to the Owner. In such event, the Contractor shall continue to assume responsibility for his performance and for completion within the required dates.

4.12.5 If, in the opinion of the Design Consultant or Owner, the actions taken by the Contractor pursuant to this Article or the progress or sequence of the Work are not accurately reflected on the construction schedule, the Contractor shall revise such schedule to accurately reflect the actual progress and sequence of the Work.

4.12.6 Failure of the Contractor to substantially comply with the requirements of this Article and the Specifications sections for construction schedules, may be considered grounds for a determination by the Owner, pursuant to Article 14, that the Contractor is failing to prosecute the Work with such diligence as will ensure its completion within the time specified.

4.12.7 The Owner may, at its sole discretion and for any reason, other than due to the fault of Contractor require the Contractor to accelerate the Work by providing overtime, Saturday, Sunday and/or holiday work and/or by having all or any Subcontractors designated by the Owner provide overtime, Saturday, Sunday, and/or holiday work. In the event that the Owner requires such acceleration a Change Order shall be issued in accordance with Article 12.

4.12.8 This Section 4.12 does not eliminate the Contractor's responsibility to comply with the local noise ordinances, all highway permit requirements and all other applicable laws, regulations, rules, ordinances, resolutions, and permit requirements.

4.12.9 The Contractor will provide the Owner assistance in the original operation of any equipment or system installed as Park of the Work, including initial start-up, testing, adjustment and balancing.

4.13 DOCUMENTS AND SAMPLES AT THE SITE

4.13.1 The Contractor shall maintain at the site for the Owner one record copy of all Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to record all changes made during construction, and approved Shop Drawings, Product Data and Samples. These shall be delivered to the Design Consultant upon completion of the Work.

4.14 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

4.14.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or any Subcontractor, Manufacturer, Supplier or distributor to illustrate some portion of the Work.

4.14.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate a material, product or system for some portion of the Work.

4.14.3 Samples are physical examples, which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

4.14.4 Manuals are manufacturer's installation, start-up, operating, and maintenance and repair instructions together with parts lists, pictures, sketches and diagrams, which set forth the manufacturer's requirements for the benefit of the Contractor and the Owner.

4.14.5 The Contractor shall prepare or have prepared at its expense and shall review, indicate approval thereupon, and submit, with reasonable promptness and in such sequence as to cause no delay in the Work or in the other work of the Owner or any Separate Contractor, all Shop Drawings, Product Data, Manuals and Samples required by the Contract Documents.

4.14.5.1 Unless otherwise directed in writing, the Contractor shall submit no less than three (3) copies of each Shop Drawing, Product Data, or Manuals to the Design Consultant. Routing of said submittals will be from the Contractor to the Design Consultant with a copy of the transmittal to the Owner. The Design Consultant will return one (1) copy of the reviewed submittal to the Contractor.

4.14.5.2 Where the Contract calls for the submittal of manufacturer's data to the Design Consultant for information only, such submittals shall be made before the commencement of any portion of the Work requiring such submission. Work performed without benefit of approved Shop Drawings for any portion of the Work is subject to removal and replacement at no cost to the Owner.

4.14.5.3 For standard manufactured items not requiring special Shop Drawings for manufacture, Contractor shall submit an electronic copy of Manufacturer's catalogue sheets showing

illustrated cuts of item to be furnished, scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams and controls, and all other pertinent information to the Owner and Design Consultant, unless otherwise directed in writing, by the Owner. One (1) copy of reviewed submissions will be returned to the Contractor.

4.14.5.4 Unless otherwise directed in writing, all other Shop Drawings, Contractor shall submit no less than three (3) legible copies of each drawing. Each drawing shall have a clear space for stamps. When phrase "by others" appears on Shop Drawings, the Contractor shall indicate on the Shop Drawing who is to furnish material or operations so marked before submittal. When the Shop Drawings are checked "revise and resubmit", the Contractor shall make corrections and submit new copies for review. The Shop Drawings shall contain the Contractor's "approval" and corrections.

4.14.5.5 For use of all trades, the Contractor shall provide such number of Shop Drawings as is required for field distribution.

4.14.5.6 The Design Consultant will review submittals and make marks to indicate corrections or revisions required and will stamp each submittal with an action stamp and will mark the stamp with the action required by the Contractor.

4.14.5.7 Contractor shall submit names of proposed Manufacturers, Material Suppliers, dealers, who are to furnish materials, fixtures, appliances or other fittings for approval as early as possible, to afford proper investigation and checking.

4.14.5.8 Transactions with manufacturers, or Subcontractors, shall be through Contractor.

4.14.5.9 Unless otherwise specified, Contractor shall submit samples in duplicate of adequate size showing quality, type, color range, finish, and texture as indicated in the Specifications.

4.14.5.10 Where Specifications require manufacturer's printed installation instructions, Contractor shall submit duplicate copies of such instructions for approval.

4.14.5.11 When several materials are specified by name for one use, Contractor shall select for use any of those so specified.

4.14.5.12 Whenever item or class of material is specified exclusively by trade name, manufacturer's name, or by catalogue reference, Contractor shall use only such item, unless written approval for substitution is secured, as outlined in the Specifications and in Section 4.15 of the General Conditions.

4.14.5.13 Contractor shall not order materials until receipt of written approval. Contractor shall furnish materials equal in every respect to approved samples.

4.14.6 By approving and submitting Shop Drawings, Product Data, Manuals and Samples, the Contractor represents that he has determined and verified all materials, field measurements, and field construction criteria related thereto, and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents. The Contractor shall adhere to any supplementary processing and scheduling instructions pertaining to Shop Drawings, which may be issued by the Design Consultant.

4.14.6.1 Parts and details not fully indicated on the Drawings shall be detailed by the Contractor in

accordance with standard engineering practice. Dimensions on the Drawings, as well as detailed drawings themselves are subject in every case to measurements of existing, adjacent, incorporated and completed, which shall be taken by the Contractor before undertaking any Work dependent on such data.

4.14.7 The Contractor shall not be relieved of responsibility for any deviation from the requirements of the Contract Documents by the Design Consultant's review of Shop Drawings, Product Data, Samples or Manuals under Paragraph 2.2.14 unless the Contractor has specifically informed the Design Consultant in writing of such deviation at the time of submission and the Design Consultant has given written approval to the specific deviation. The Contractor shall not be relieved from responsibility to Owner for errors or omissions in the Shop Drawings, Product Data, Samples, or Manuals by virtue of the Design Consultant's review or approval thereof.

4.14.8 The Contractor shall make corrections required by the Design Consultant and shall resubmit the required number of corrected copies of Shop Drawings or new Product Data or Samples. The Contractor shall direct specific attention, in writing on resubmitted Shop Drawings, Product Data or Samples or Manuals, to revisions other than those requested by the Design Consultant on previous submittals. Re-submittals necessitated by required corrections due to Contractor's errors or omissions shall not be cause for extension of Contract Time or an increase in the Contract Sum.

4.14.8.1 No portion of the Work requiring submission of Shop Drawings, Product Data, Samples or Manuals shall be commenced until the submittal has been approved by the Design Consultant as provided in Article 2. All such portions of the Work shall be in accordance with approved submittals.

4.14.9 Shop Drawings, Product Data and Samples shall be dated and shall bear the name of the Project; a description or the names or equipment, materials and items; and complete identification of locations at which materials or equipment are to be installed. Shop Drawings shall be stamped and signed stating that the Contractor has determined and verified all materials, field measurements, and field construction criteria related thereto and that he has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

4.14.10 Submittals of Shop Drawings, Product Data, Samples or Manuals shall be accompanied by a transmittal letter, in duplicate, containing the name of the Project, the Contractor's name, the number of Shop Drawings, Product Data, Samples, or Manuals, identification of Specification section and other pertinent data.

4.15 EQUAL PRODUCTS AND SUBSTITUTIONS

4.15.1 All materials, supplies and articles furnished under the Contract shall, whenever specified and otherwise practicable, be the standard products of recognized, reputable manufacturers. Unless otherwise specifically provided in the Contract Documents, the naming of a certain brand, make, manufacturer or article, device, product, material, fixture or type of construction shall convey the general style, type, character and standard of quality of the article desired and shall not be construed as limiting competition. The Contractor, in such cases, may with Owner’s written approval, use any brand, make, manufacturer, article, device, product, material, fixture, form or type of construction which in the judgment of the Design Consultant is equal to that specified. An item may be considered equal to the item so named or described if, in the opinion of the Owner and Design Consultant (1) it is at least equal in quality, durability, appearance, strength, and design; (2) it will perform at least equally the specific function imposed by the general

design for the Work being contracted for or the material being purchased; and (3) it conforms substantially, even with deviations, to the detailed requirements for the item in the Specifications. Approval by the Owner and Design Consultant will be granted based upon considerations of quality, workmanship, economy of operation, suitability for the purpose intended, warranty and acceptability for use on the Project.

4.15.2 To obtain such approval on makes or brands of material other than those specified in Contract Documents, and not previously approved at the time the Owner received bids for the construction of the Project, the Contractor's request for approval of any substitution shall include:

.1 Complete data substantiating compliance of the proposed substitution with the Contract Documents;

.2 Product identification including manufacturers' name, address, and phone number;

.3 Manufacturer's literature showing complete product description, performance and test data, and all reference standards;

.4 Samples and colors in the case of articles or products;

.5 Names and addresses of similar projects on which the product was used and date of installation;

.6 For construction methods, include a detailed description for the proposed method and drawings illustrating same;

.7 Itemized comparison of proposed substitution with product or method specified and any cost reduction, which shall benefit the Owner;

.8 Accurate cost data on proposed substitution in comparison with product or method specified;

.9 All directions, specifications, and recommendations by manufacturers for installation, handling, storing, adjustment, and operation; and

.10 Item by item comparison of characteristics of substitution item with those items specified.

4.15.3 The Contractor shall also submit with his request for approval a sworn and notarized statement which shall include all of the following representations by the Contractor, namely that:

.1 He has investigated the proposed product or method and determined that it is equal or better in all respects to that specified and that it fully complies with all requirements of the Contract Documents;

.2 He will meet all contract obligations with regard to this substitution;

.3 He will coordinate installation of accepted substitutions into the Work, making all such changes and any required schedule adjustments, at no additional cost to the Owner, as may be required for the Work to be complete in all respects;

.4 He waives all Claims for additional costs and additional time related to substitutions, which

consequently become apparent. He also agrees to hold the Owner harmless from Claims for extra costs and time incurred by other Subcontractors and suppliers, or additional services which may have to be performed by the Design Consultant, for changes for extra work that may, at some later date, be determined to be necessary in order for the Work to function in the manner intended in the Contract Documents;

.5 He will provide the same warranty and guarantee, and perform any work required in accordance therewith, for the substitution that is applicable to the specified item for which the substitution is requested;

.6 Material will be installed, handled, stored, adjusted, tested, and operated in accordance with the manufacturers' recommendation and as specified in the Contract Documents.

.7 In all cases new materials will be used unless this provision is waived by Notice from the Owner or his Design Consultant, or unless otherwise specified in the Contract Documents;

.8 All material and workmanship will be in every respect in accordance with that which, in the opinion of the Owner or Design Consultant, is in conformity with approved modern practice; and

.9 He has provided accurate cost data on the proposed substitution in comparison with the product or method specified.

4.15.4 Subject to the provisions of any applicable laws, approval for substitutions or equal products shall be at the sole discretion of the Owner, shall be in writing to be effective, and the decision of the Owner shall be final. The Owner or Design Consultant may require tests of all materials proposed for substitution so submitted to establish quality standards, at the Contractor's expense. After approval of a substitution, if it is determined that the Contractor submitted defective information or data regarding the substitution upon which Owner's approval was based, and that unexpected or uncontemplated extensive redesign or rework of the Project will be required in order to accommodate the substitution, or that the substituted item will not perform or function as well as the specified item for which substitution was requested, the Contractor will be required to furnish the original specified item or obtain approval to use another substitution; the Contractor shall pay all costs, expenses or damages associated with or related to the unacceptability of such a substitution and the resultant utilization of another item and no time extension shall be granted for any delays associated with or related to such substitution.

4.15.5 If a substitution is approved, no further change in brand or make will be permitted unless satisfactory, written evidence is presented to and approved by the Owner that the manufacturer cannot make scheduled delivery of the approved substituted item. The Owner will not consider substitutions for approval if:

.1 The proposed substitution is indicated or implied on the Contractor's Shop Drawing or product data submittal and has not been formally submitted for approval by the Contractor in accordance with the above-stated requirements, or

.2 Acceptance of the proposed substitution will require substantial design revisions to the Contract Documents or is otherwise not acceptable to the Owner and Design Consultant.

4.15.6 Except as otherwise provided for by the provisions of any applicable laws, the Contractor shall not have any right of appeal from the decision of the Owner rejecting any materials submitted if the Contractor fails to obtain the approval for substitution under this Article.

4.16 USE OF SITE

4.16.1 The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits, easements, right-of-way agreements and within the limits of construction as shown on the Contract Documents. The Contractor shall not unreasonably encumber the site, in the opinion of the Owner, with any materials, equipment or trailers nor shall he block the entrances or otherwise prevent reasonable access to the site, other working and parking areas, completed portions of the Work and/or properties, storage areas, areas of other facilities that are adjacent to the worksite. If the Contractor fails or refuses to move said material, equipment or trailers within twenty four (24) hours of notification by the Owner, to so do, the Owner shall have the right, without further notice, to remove, at the Contractor's expense, any material, equipment and/or trailers which the Owner deems are in violation of this Paragraph.

4.17 CUTTING AND PATCHING OF WORK

4.17.1 The Contractor shall be responsible for all cutting, fitting or patching that may be required to complete the Work or to make its several parts fit together properly and in accordance with the Contract Documents.

4.17.2 The Contractor shall not damage or endanger any portion of the Work or the work of the Owner or any Separate Contractors by cutting, patching or otherwise altering any work, or by excavation. The Contractor shall not cut or otherwise alter the work of the Owner or any Separate Contractor except with the written consent of the Owner and of such Separate Contractor. The Contractor shall not unreasonably withhold from the Owner or any Separate Contractor his consent to cutting or otherwise altering the Work. The Owner shall not be required to accept work with a cut, splice, or patch when such cut, splice or patch is not generally accepted practice for the particular work involved or is otherwise unworkmanlike in the opinion of the Design Consultant or the Owner.

4.17.3 Existing structures and facilities including but not limited to building, utilities, topography, streets, curbs, walks, etc., that are damaged or removed due to required excavations or other construction work, shall be patched, repaired or replaced by the Contractor to satisfaction of the Design Consultant and the Owner of such structures and facilities and authorities having jurisdiction. In event the local jurisdictional authorities require that such repairing and patching be done with their own labor and materials, the Contractor shall abide by such regulations and pay for such work with no increase in the Contract Sum.

4.18 CLEANING UP

4.18.1 The Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of the Work and before final payment is made, he shall remove all his waste materials and rubbish from and about the Project as well as all his tools, construction equipment, machinery and surplus materials.

4.18.2 If the Contractor fails to clean up during or at the completion of the Work, the Owner may do so as provided in Section 6.3 and the cost thereof shall be charged to the Contractor.

4.19 COMMUNICATIONS

4.19.1 All communications from the Contractor relating to the Contract Documents or the construction schedule will be directed to the Design Consultant and copied to the Owner. Similarly, all

correspondence from the Owner or Design Consultant will be directed to the Contractor and copied to the Owner or Design Consultant.

4.20 ROYALTIES AND PATENTS

4.20.1 The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights arising out of the Work and shall save the Owner harmless from loss on account thereof.

4.21 INDEMNIFICATION

4.21.1 To the fullest extent permitted by law, the Contractor shall, at its sole cost and expense, indemnify, defend, and hold harmless the Owner and its agents, representatives, and employees from and against all claims, actions, judgments, costs, liabilities, penalties, damages, losses and expenses, including but not limited to attorneys' fees, arising out of and/or resulting from the performance of the Work, provided that any such claim, action, judgment, cost, liability, penalty, damage, loss or expense is caused by any negligent act, error or omission of the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be legally liable. The above obligation shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person described in this Section 4.21.1. The parties agree that this indemnification clause is an "evidence of indebtedness" for purpose of N.C. Gen. Stat. § 6-21.2. The parties also specifically acknowledge that the Owner is a public body and it is the intent of the parties that the Owner not incur any expenses when the Contractor is solely responsible for the claims.

4.21.2 In any and all claims against the Owner or the Design Consultant or any of their agents, representatives, or employees by any employee of the Contractor, any Subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, the indemnification obligation under this Section 4.21 shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

4.21.3 No provision of this Section 4.21 shall give rise to any duties on the part of the Design Consultant or the Owner, or any of their agents, representatives, or employees.

4.22 PERSONS AUTHORIZED TO SIGN DOCUMENTS

4.22.1 The Contractor, within five (5) days after the earlier of the date of a Notice to Proceed or the date of the Owner-Contractor Agreement, shall file with the Owner a list of all persons who are authorized to sign documents such as contracts, certificates, and affidavits on behalf of the Contractor and to fully bind the Contractor to all the conditions and provisions of such documents, except that in the case of a corporation he shall file with the Owner a certified copy of a resolution of the Board of Directors of the corporation in which are listed the names and titles of corporation personnel who are authorized to sign documents on behalf of the corporation and to fully bind the corporation to all the conditions and provisions of such documents.

4.23 CONDITIONS AFFECTING THE WORK

4.23.1 The Contractor shall be responsible for taking all steps necessary to ascertain the nature and

location of the Work and the general and local conditions that can affect the Work or the cost thereof. Failure by the Contractor to fully acquaint himself with conditions which may affect the Work, including, but not limited to conditions relating to transportation, handling, storage of materials, availability of labor, water, roads, weather, topographic and subsurface conditions, Multi-Prime Contract conditions, applicable provisions of law, and the character and availability of equipment and facilities needed prior to and during the execution of the Work, shall not relieve the Contractor of his responsibilities under the Contract Documents and shall not constitute a basis for an adjustment in the Contract Sum or the Contract Time under any circumstances. The Owner assumes no responsibility for any understanding or representation about conditions affecting the Work made by any of his officers, employees, representatives, or agents prior to the execution of the Contract, unless such understandings or representations are expressly stated in the Contract Documents.

4.23.2 If in the execution of the Work any valuable items or materials of any kind are discovered buried or hidden within the Work, such items or materials shall be the property of the Owner. The Contractor shall take reasonable precautions to prevent any persons from removing or damaging such items or materials and shall immediately upon discovery thereof and before removal, acquaint the Owner or the Design Consultant with such discovery and carry out, at the expense of the Owner, the Owner's or the Design Consultant's orders as to disposal of the same.

4.24 COMPLIANCE WITH BOARD POLICIES AND PROCEEDURES

The Contractor acknowledges that Board policies are available for review at www.nhcs.net/policies/policymanual.htm and agrees to comply with the policies. The Contractor also agrees to comply with the following provisions:

4.24.1 The Contractor, its Subcontractors and employees shall not possess or carry, whether openly or concealed, any gun, rifle, pistol, or explosive on any property owned by the Owner. This includes firearms locked in containers, vehicles or firearm racks within vehicles. The Contractor, its Subcontractors and employees shall not cause, encourage or aid a minor, who is less than 18 years old to possess or carry, whether openly or concealed, any weapons on any property owned by the Owner.

4.24.2 The Contractor, its Subcontractors and employees, are prohibited from profane, lewd, obscene or offensive conduct or language, including engaging in sexual harassment.

4.24.3 The Contractor and its Subcontractors shall not manufacture, transmit, conspire to transmit, possess, use or be under the influence of any alcoholic or other intoxicating beverage, narcotic drug, hallucinogenic drug, amphetamine, barbiturate, marijuana or anabolic steroids, or possess, use, transmit or conspire to transmit drug paraphernalia on any property owned by the Owner.

4.24.4 The Contractor and its Subcontractors may not at any time use or display tobacco or nicotine-containing products, including but not limited to electronic cigarettes (e-cigarettes), on school premises, both indoor and outdoor. The prohibition of the display of tobacco or nicotine products shall not extend to a display that has a legitimate instructional or pedagogical purpose. For purposes of this Contract, “tobacco product” is defined to include cigarettes, cigars, blunts, bidis, pipes, chewing tobacco, snuff, and any other items containing or reasonably resembling

tobacco, tobacco products, or any facsimile thereof. "Tobacco use" includes smoking, chewing, dipping, or any other use of tobacco products.

4.24.5 The Contractor, its Subcontractors and employees shall not solicit from or sell to students or staff within the Owner's facilities or campuses, and shall not give gifts of any value to school system employees.

4.24.6 Operators of all commercial vehicles on any property owned by the Owner shall be subject to post-accident, random, reasonable suspicion and follow-up testing for drugs and alcohol.

4.24.7 The Contractor, its Subcontractors and employees are prohibited from using access to the site pursuant to this Agreement as a means to date, court, or enter into a romantic or sexual relationship with any student enrolled in the New Hanover County Schools. The Contractor agrees to indemnify the Owner for claims against the Owner resulting from relationships which have occurred or may occur between a student and an employee of the Contractor or Subcontractor.

4.24.8 Lunsford Act/Criminal Background Checks. The Contractor shall conduct at its own expense sexual offender registry checks on each of its owners, employees, agents, or Subcontractors ("contractual personnel") who will engage in any service on or delivery of goods to school system property or at a school-system sponsored event, except checks shall not be required for individuals who are solely delivering or picking up equipment, materials, or supplies at: (1) the administrative office or loading dock of a school; (2) non-school sites; (3) schools closed for renovation; or (4) school construction sites.. The checks shall include at a minimum checks of the State Sex Offender and Public Protection Registration Program, the State Sexually Violent Predator Registration Program, and the National Sex Offender Registry ("the Registries"). For the Contractor's convenience only, all of the required registry checks may be completed at no cost by accessing the United States Department of Justice Sex Offender Public Website at http:// www. nsopw.gov/. The Contractor shall provide certification that the registry checks were conducted on each of its contractual personnel providing services or delivering goods under this Agreement on the Sexual Offender Registry Check Certification Form (attached as Appendix A) prior to the commencement of such services or the delivery of such goods. The Contractor shall conduct a current initial check of the registries (a check done more than 30 days prior to the date of this Agreement shall not satisfy this contractual obligation). In addition, Contractor agrees to conduct the registry checks and provide a supplemental certification before any additional contractual personnel are used to deliver goods or provide services pursuant to this Agreement. Contractor further agrees to conduct annual registry checks of all contractual personnel and provide annual certifications at each anniversary date of this Agreement. Contractor shall not assign any individual to deliver goods or provide services pursuant to this Agreement if said individual appears on any of the listed registries. Contractor agrees that it will maintain all records and documents necessary to demonstrate that it has conducted a thorough check of the registries as to each contractual personnel, and agrees to provide such records and documents to the school system upon request. Contractor specifically acknowledges that the school system retains the right to audit these records to ensure compliance with this Section at any time in the school system's sole discretion. Failure to comply with the terms of this provision shall be grounds for immediate termination of the Agreement. In addition, the Owner may conduct additional criminal records checks at the Owner's expense. If the school system exercises this right to conduct additional criminal records checks, Contractor agrees to provide within seven (7) days of request the full name, date of birth, state of residency for the past ten years, and any additional information requested by the school system for all contractual personnel who may deliver goods or perform services

under this Agreement. Contractor further agrees that it has an ongoing obligation to provide the school system with the name of any new contractual personnel who may deliver goods or provide services under the Agreement. The Owner reserves the right to prohibit any contractual personnel of Contractor from delivering goods or providing services under this Agreement if the Owner determines, in its sole discretion, that such contractual personnel may pose a threat to the safety or well-being of students, school personnel or others.

4.24.9 Contractor shall not employ any individuals to provide services to the Owner who are not authorized by federal law to work in the United States. Contractor represents and warrants that it is aware of and in compliance with the Immigration Reform and Control Act and North Carolina law (Article 2 of Chapter 64 of the North Carolina General Statutes) requiring use of the E-Verify system for employers who employ twenty-five (25) or more employees and that it is and will remain in compliance with these laws at all times while providing services pursuant to this Agreement. Contractor shall also ensure that any of its Subcontractors (of any tier) will remain in compliance with these laws at all times while providing subcontracted services in connection with this Agreement. Contractor is responsible for providing affordable health care coverage to all of its full-time employees providing services to the School System. The definitions of "affordable coverage" and "full-time employee" are governed by the Affordable Care Act and accompanying IRS and Treasury Department regulations.

4.24.10 The Contractor, its Subcontractors and employees shall not interact with any students. Nothing in Paragraph 4.24 shall be construed to prevent the Contractor, its Subcontractors and employees from taking necessary measures to protect students, staff or other employees.

4.24.11 The Contractor shall at all times enforce strict discipline and good order among its employees and shall not employ any unfit person or anyone not skilled in the task assigned to it. The Owner may require the Contractor to remove any employee the Owner deems incompetent, careless or otherwise objectionable.

4.24.12 All agents and workers of the Contractor and its Subcontractors shall wear identification badges provided by the Contractor at all times they are on the Owner's property. The identification badges shall at a minimum display the company name, telephone number, employee name and a picture of the employee.

4.24.13 The Contractor shall comply with the Owner's site or school building access procedures when working on any existing school campus.

4.24.14 Anti-Nepotism. The Contractor warrants that, to the best of its knowledge and in the exercise of due diligence, none of its corporate officers, directors, or trustees and none of its employees who will directly provide services under this Agreement are immediate family members of any member of the Owner's Board of Education or of any principal or central office staff administrator employed by the Owner. For purposes of this provision, "immediate family" means spouse, parent, child, brother, sister, grandparent, or grandchild, and includes step, half, and in-law relationships. Should Contractor become aware of any family relationship covered by this provision or should such a family relationship arise at any time during the term of this Agreement, Contractor shall immediately disclose the family relationship in writing to the Superintendent. Unless formally waived by the Owner, the existence of a family relationship covered by this Agreement is grounds for immediate termination by Owner without further financial liability to Contractor.

4.24.15 Restricted Companies Lists. Contractor represents that as of the date of this Agreement, Contractor is not included on the Final Divestment List created by the North Carolina State Treasurer pursuant to N.C. Gen. Stat. § 147-86.58. Contractor also represents that as of the date of this Agreement, Contractor is not included on the list of restricted companies determined to be engaged in a boycott of Israel created by the North Carolina State Treasurer pursuant to N.C. Gen. Stat. § 147-86.81.

ARTICLE 5

SUBCONTRACTORS

5.1 DEFINITION

5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform any of the Work at the site. The term Subcontractor may be referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Subcontractor or his authorized representative. The term Subcontractor does not include any Separate Contractor or his subcontractors.

5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform any of the Work at the site or who contracts to perform or supply any of the Work under the scope of a Subcontractor's subcontract. The term Sub-subcontractor may be referred to throughout the Contract Documents as if singular in number and masculine in gender and means a Sub-subcontractor or an authorized representative thereof.

5.1.3 Nothing contained in the Contract Documents is intended to, nor shall it create, any contractual relationship between the Owner, the Design Consultant, or any of their agents, consultants, employees, independent contractors, or representatives and any Subcontractor, Sub-subcontractor, Supplier or Vendor of the Contractor, except the relationship between Owner and Contractor, but the Owner shall be entitled to performance of all obligations intended for his benefit, and to enforcement thereof.

5.1.4 The Owner and Design Consultant will not deal directly with any Subcontractor, Sub-subcontractor or Material Supplier. Communication will be made only through the Contractor. Subcontractor, Sub-subcontractors or Material Suppliers shall route requests for information or clarification through the Contractor to the Design Consultant.

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.1 The Contractor, in compliance with the requirements of the Contract Documents and within ten (10) days after the Notice to Proceed, shall furnish in writing to the Owner the names of the persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work. The Owner will promptly reply to the Contractor in writing stating whether or not the Owner, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner to reply within a reasonable time shall constitute notice of no reasonable objection. The Contractor understands and agrees that no contractual agreement exists for any part of the Work under this Contract between the Owner and any of the Contractor's Subcontractors or Sub-subcontractors. Further, the Contractor understands and agrees that he alone is responsible to

the Owner for the Work under this Contract and that any review of Subcontractors or Sub-subcontractors by the Owner will not in any way make the Owner responsible to any Subcontractor, nor responsible for the actions or failures of any Subcontractor or Sub-subcontractor.

5.2.1.1 The Contractor shall identify in the list of names of the Subcontractors proposed, those Subcontractors that are minority or Historically Underutilized Businesses (HUBs) and indicate the portion of the Work that each Subcontractor will perform.

5.2.2 The Contractor shall not contract with any such proposed person or entity to whom the Owner has made reasonable objection under the provisions of Paragraph 5.2.1. The Contractor shall not be required to contract with anyone to whom he has a reasonable objection.

5.2.3 If the Owner has reasonable objection to any proposed person or entity under Paragraph 5.2.1, the Contractor shall name a substitute to whom the Owner has no reasonable objection. The Contract Sum shall be increased or decreased by the difference in cost occasioned by such substitution and an appropriate Change Order shall be issued, subject to an audit of said difference by the Owner; provided, however, that no increase in the Contract Sum shall be allowed for any such substitution unless the Contractor has acted promptly and responsively in submitting names as required by Paragraph 5.2.1 and the original proposed Subcontractor was: (i) able to carry out his work under his proposed subcontract, (ii) able to comply with all applicable laws, (iii) was an ongoing business in the field of his proposed subcontract, and (iv) had a labor force, capital and a means of supply compatible with the scope of his proposed subcontract.

5.2.4 If the Owner requires a change of any proposed Subcontractor or person or organization previously accepted by him on the Project, the Contract Sum shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued, subject to an audit by Owner.

5.2.5 The Contractor shall notify the Owner and the Design Consultant of any substitution for any Subcontractor identified in accordance with Subparagraph 5.2.1.1. The Contractor shall make no substitution for any Subcontractor, person or entity previously selected if the Owner or the Design Consultant makes reasonable objection to such substitution. Also, Contractor may make no substitution of Subcontractors in violation of applicable law.

5.2.6 If during the duration of the Project, the Contractor effects a substitution for any Subcontractor per Paragraph 5.2.5, or if additional subcontract opportunities become available, the Contractor shall make a good faith effort to utilize minority and Historically Underutilized Businesses (HUBs).

5.3 SUBCONTRACTUAL RELATIONS

5.3.1 By an appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Contract Documents, assumes toward the Owner. Said agreement shall preserve and protect the rights of the Owner under the Contract Documents with respect to the Work to be performed by the Subcontractor so that the subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the agreement between the Contractor and Subcontractor, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by these Contract Documents,

has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with his Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract, copies of the Contract Documents to which the Subcontractor will be bound by this Section 5.3, and identify to the Subcontractor any terms and conditions of the proposed Subcontract which may be at variance with the Contract Documents. Each Subcontractor shall similarly make copies of such Contract Documents available to his Sub-subcontractors.

5.3.2 The provisions herein regarding Subcontractor approvals shall in no way affect the liability of the Contractor to the Owner regarding performance of all obligations by or payment of Subcontractors. Approval to subcontract with any given Subcontractor shall not to any degree relieve the Contractor of his obligation to perform or have performed to the full satisfaction of the Owner the Work required by this Contract.

5.3.3 The Contractor shall submit Notice to the Owner of any Claims by Subcontractors for which the Owner is believed to be responsible, in strict conformance with the same time requirements and other procedures established for the submission of the Contractor's Claims to the Owner.

5.4 QUALIFICATION SUBMITTALS

5.4.1 Specific qualification submittals may be required of Subcontractors, installers and suppliers for certain critical items of the Work. Required qualification submittals are set forth in detail in the Specifications and shall be collected and submitted by the Contractor for review and approval by the Design Consultant. All information required of a single Subcontractor, installer or supplier shall be contained in a single, complete submittal. The Contractor shall submit the required qualification information within ten (10) days after receipt of the Design Consultant's request.

5.4.2 The Owner and Design Consultant shall reject any proposed Subcontractor, installer or supplier, or any qualification submittals related thereto, for the following reasons:

.1 The Contractor's failure to submit requested information within the specified time; or

.2 The Contractor's failure to provide all of the requested information; or

.3 The Contractor's submission of a Subcontractor, installer or supplier, or qualifications thereof, which are unacceptable in the judgment of the Owner or Design Consultant.

5.4.3 Should the Owner or Design Consultant have reasonable objection to any proposed Subcontractor, installer or supplier, the Contractor shall submit another person or firm who are reasonably acceptable to the Owner and Design Consultant.

5.5 PREPARATORY WORK

5.5.1 Before starting a portion of the Work, the Contractor and the responsible Subcontractor shall carefully examine all preparatory work that has been executed to receive his work. The Subcontractor shall check carefully, by whatever means are required, to ensure that his work and adjacent related work will finish to proper contours, planes and levels. He shall promptly notify the Contractor and the Design Consultant of any defects or imperfections in preparatory work, which will, in any way, affect satisfactory completion of his work. Absence of such notification will be construed as an acceptance of preparatory work and later Claims of defects therein will not be recognized.

5.5.2 Under no conditions shall a portion of the Work proceed prior to preparatory work having been completed, cured, dried, and otherwise made satisfactory to receive such related work. Responsibility for timely installation of all materials rests solely with the Contractor, who shall maintain coordination control at all times.

ARTICLE 6

WORK BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM WORK AND TO AWARD SEPARATE CONTRACTS

6.1.1 The Owner reserves the right to perform work related to the Project with his own forces, and to award separate contracts in connection with other portions of the Project or other work on the site under these or similar conditions of the Contract.

6.1.2 When separate contracts are awarded for different portions of the Project or other work on the site, the term Contractor in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

6.2 MUTUAL RESPONSIBILITY

6.2.1 The Contractor shall afford Separate Contractors and the Owner reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work and shall properly connect and coordinate the Work with that of the Owner and other contractors to store his apparatus, materials, supplies and equipment in such orderly fashion at the site of the Work as will not unduly or unreasonably interfere with the progress of the Work or the work of any other contractors.

6.2.1.1 If the execution or result of any part of the Work depends upon any work of the Owner or of any Separate Contractor, the Contractor shall, prior to proceeding with the Work, inspect and promptly report to the Owner in writing any apparent discrepancies or defects in such work of the Owner or of any Separate Contractor that render it unsuitable for such proper execution or result of any part of the Work.

6.2.1.2 Failure of the Contractor to so inspect and report shall constitute an acceptance of the Owner's or Separate Contractor's work as fit and proper to receive the Work, except as to defects which may develop in the Owner's or Separate Contractor's work after completion of the Work and which the Contractor could not have discovered by its inspection prior to completion of the Work.

6.2.2 Should the Contractor cause damage to the Work or property of the Owner or of any Separate Contractor on the Project, or to other work on the site, or delay or interfere with the Owner's work on ongoing operations or facilities or adjacent facilities or said Separate Contractor's work, the Contractor shall be liable for the same; and, in the case of another contractor, the Contractor shall attempt to settle said Claim with such other contractor prior to such other contractor's institution of litigation or other proceedings against the other contractor.

6.2.2.1 Should a Separate Contractor be declared in default by the Owner, the Owner shall not be obligated to hire a contractor to perform the work of the Separate Contractor during the time the Separate Contractor's surety is remedying the default pursuant to Paragraph 3.4.2.

6.2.2.2 If such Separate Contractor sues the Owner or Design Consultant on account of any damage, delay or interference cause or alleged to have been caused by the Contractor, the Owner shall notify the Contractor, who shall defend the Owner and Design Consultant in such proceedings at the Contractor's expense. If any judgment or award is entered against the Owner or Design Consultant in such proceedings, the Contractor shall satisfy the same and shall reimburse the Owner and Design Consultant for all damages, expenses, attorney's fees and other costs which the Owner or Design Consultant incurs as a result thereof.

6.2.3 Should a Separate Contractor cause damage to the Work or to the property of the Contractor or cause delay or interference with the Contractor's performance of the Work, the Contractor shall present directly to said Separate Contractor any Claims it may have as a result of such damage, delay or interference (with an information copied to the Owner) and shall attempt to settle its Claim against said Separate Contractor prior to the institution of litigation or other proceedings against said Separate Contractor.

6.2.3.1 In no event shall the Contractor seek to recover from the Owner or the Design Consultant, and the Contractor hereby waives any Claims against the Owner and Design Consultant relating to any costs, expenses (including, but not limited to, attorney's fees) or damages or other losses incurred by the Contractor as a result of any damage to the Work or property of the Contractor or any delay or interference caused by any Separate Contractor.

6.2.4 Whenever Contractor receives items from another contractor or from Owner for storage, erection or installation, the Contractor receiving such items shall give receipt for items delivered, and thereafter will be held responsible for care, storage and any necessary replacing of item or items received.

6.2.5 When certain items of equipment and other work are indicated as "NIC" (not in contract), or to be furnished and installed under other contracts, any requirements set forth in the Contract Documents for preparation of openings, provision of backing, etc., for receipt of such "NIC" work will be furnished upon written request of the Contractor who shall properly form and otherwise prepare his work in a satisfactory manner to receive such "NIC" work.

6.3 OWNER'S RIGHT TO PERFORM DISPUTED WORK

6.3.1 If a dispute arises between the Contractor and Separate Contractors as to their responsibility for cleaning up as required by Section 4.18 or for accomplishing coordination or doing required cutting, filling, excavating or patching as required by Section 4.17, the Owner may carry out such work and charge the cost thereof to the responsible party as the Owner shall determine to be just.

6.4 COORDINATION OF THE WORK

6.4.1 By entering into this Contract, Contractor acknowledges that there may be other contractors on the site whose work will be coordinated with that of his own. Contractor expresses, warrants and guarantees that he will cooperate with other contractors and will do nothing to delay, hinder or interfere with the work of other Separate Contractors, the Owner or Design Consultant. Contractor also expressly agrees that, in the event his work is hindered, delayed, interfered with or otherwise affected by a Separate Contractor, his sole remedy will be a direct action against the Separate Contractor as described in this Article 6. Contractor will have no remedy, and hereby expressly waives any remedy, against the Owner and/or the Design Consultant on account of delay, hindrance, interference or other event caused by a Separate Contractor.

6.4.2 When certain items of equipment and other work are indicated as "NIC" (not in contract), or to be furnished and installed under other contracts, any requirements set forth in the Contract Documents for preparation of openings, provision of backing, etc., for receipt of such "NIC" work will be furnished upon written request to the Contractor who shall properly form and otherwise prepare his work in a satisfactory manner to receive such "NIC" work.

ARTICLE 7

MISCELLANEOUS PROVISIONS

7.1 GOVERNING LAW

7.1.1 This Contract shall be governed by the laws of the State of North Carolina. The Contractor and Owner agree that New Hanover County, North Carolina shall be the proper venue for any litigation arising out of this Agreement.

7.1.2 Each and every provision of law and clause required by law to be inserted in this Contract shall be deemed to be inserted herein and the Contract shall be read and enforced as though it were included herein. If through mistake or otherwise, any such provision is not inserted or is not correctly or fully inserted, then upon the application of either party, the Contract shall forthwith be physically amended to make such insertion.

7.2 SUCCESSORS AND ASSIGNS

7.2.1 The Owner and the Contractor each binds himself, his partners, successors, assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract or sublet it as a whole without the written consent of the Owner, nor shall the Contractor assign any moneys due or to become due to him hereunder, without the previous written consent of the Owner and the Contractor's Surety.

7.3 CLAIMS AND DAMAGES

7.3.1 Should the Contractor, Subcontractor or any Sub-subcontractor suffer injury or damage to person or property because of any act or omission of the Owner or Design Consultant, or of any of their employees, agents or others for whose acts either is legally liable, the Claim on behalf of the Contractor its Subcontractors or Sub-subcontractors shall be made by giving Notice to the Owner, as provided in Article 15 ; otherwise, the Contractor, Subcontractors and Sub-subcontractors shall have waived any and all rights he may have against the Owner or the Design Consultant, or their employees, representatives and agents. The Contractor shall indemnify, defend and hold the Owner harmless from any Claim by a Subcontractor that is waived because it is not filed in strict conformance with this Paragraph or any other provision of the Contract regarding Claims.

7.4 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

7.4.1 The Contractor shall furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in a form and with a Surety satisfactory to the Owner.

7.4.2 The Contractor is required to furnish in duplicate a Performance Bond and a Labor and Material Payment Bond, each in the amount of one hundred percent (100%) of the Contract Sum, written by a surety company licensed to do business in North Carolina and with a minimum AM Best "A-" rating or comparable rating from another service reasonably acceptable to Owner.

7.5 RIGHTS AND REMEDIES

7.5.1 The duties and obligations of the Contractor imposed by the Contract Documents and the rights and remedies of the Owner available thereunder shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law.

7.5.2 Except as may be specifically agreed in writing, the failure of the Owner or the Design Consultant to insist in any one or more instances upon the strict performance of any one or more of the provisions of the Contract, or to exercise any right herein contained or provided by law, shall not be construed as a waiver or relinquishment of the performance of such provisions or right(s) or of the right to subsequently demand such strict performance or exercise such right(s), and the rights shall continue unchanged and remain in full force and effect.

7.5.3 The Contractor agrees that he can be adequately compensated by money damages for any breach of the Contract which may be committed by the Owner and hereby agrees that no default, act, or omission of the Owner or the Design Consultant, except for failure to make progress payments as required by the Contract Documents, shall constitute a material breach of the Contract entitling the Contractor to cancel or rescind the provisions of the Contract or (unless the Owner shall so consent or direct in writing) to suspend or abandon performance of all or any part of the Work. The Contractor hereby waives any and all rights and remedies to which he might otherwise be or become entitled, save only his right to money damages.

7.6 TESTS AND INSPECTIONS

7.6.1 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any portion of the Work to be inspected, tested, or approved, the Contractor shall give the Owner and Design Consultant timely Notice of its readiness so the Design Consultant and the Owner may observe such inspection, testing or approval. Unless otherwise specifically provided in the Contract Documents, the Contractor shall bear all costs of such inspections, tests or approvals, except that Owner shall pay for "special inspections" as defined and required in Section 1704, the North Carolina State Building Code, or successor section. In the event that such "special inspections" reveal a failure of the Work to comply with the Contract Documents or applicable laws, ordinances, regulations or orders of public authorities having jurisdiction, Contractor shall reimburse the Owner for the costs of such "special inspections".

7.6.1.1 Unless otherwise stipulated in the Contract Documents, the Contractor shall pay for all utilities required for testing of installed equipment of all of his work and work of each Subcontractor. Boiler fuel other than gas shall be provided by Subcontractor furnishing boilers. Labor and supervision required for making such tests shall be provided at no additional cost to the Owner.

7.6.2 If the Design Consultant or the Owner determines that any portion of the Work requires additional inspection, testing, or approval which Paragraph 7.6.1 does not include, the Owner will instruct the Contractor to order such additional inspection, testing or approval, and the Contractor shall give Notice as provided in Paragraph 7.6.1. If such additional inspection or testing reveals a failure of any portion of the Work to comply (1) with the requirements of the

Contract Documents, or (2) with respect to the performance of the Work, with laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction, the Contractor shall bear all costs thereof, including compensation for the Design Consultant's and Owner's additional construction management expenses made necessary by such failure.

7.6.3 With regard to inspections and tests, the costs of which the Owner is responsible for paying, they will be made by a pre-qualified, independent testing agency selected by the Owner. The cost of the initial services of such agency will be paid by the Owner. When the initial tests indicate non-compliance with the Contract Documents, any subsequent testing occasioned by non-compliance shall be performed by the same agency and the cost thereof shall be borne by the Contractor. Representatives of the testing agency shall have access to the Work at all times. The Contractor shall provide facilities for such access in order that the agency may properly perform its functions.

7.6.4 The independent testing agency, contracted by the Owner, shall prepare the test reports, logs, and certificates applicable to the specific inspections and tests and promptly deliver the specified number of copies to the designated parties. Certificates of inspection, testing or approval required by public authorities shall be secured by the Contractor and promptly delivered by him to the Owner, in adequate time to avoid delays in the Work or final payment therefore.

7.6.5 If the Design Consultant or the Owner is to observe the inspections, tests or approvals required by the Contract Documents, laws, ordinances, rules, regulations, or order of any public authority having jurisdiction or that are required to establish compliance with the Contract Documents, he will do so promptly and, where practicable, at the normal place of testing.

7.6.6 The Contractor shall pay for and have sole responsibility for inspections or testing performed exclusively for his own convenience.

7.7 UNENFORCEABILITY OF ANY PROVISION

7.7.1 If any provision of this Contract is held as a matter of law to be unenforceable or unconscionable, the remainder of the Contract shall be enforceable without such provision.

7.8 ATTORNEYS' FEES AND OTHER EXPENSES

7.8.1 The Contractor hereby agrees that he will not submit, assert, litigate or otherwise pursue any frivolous or unsubstantiated Claims or Claims he has specifically waived under the terms of the Contract Documents. In the event that the Contractor's or its Subcontractor’s or Sub-subcontractor’s Claims, or any separate item of a Claim, is without substantial justification, the Contractor shall reimburse the Owner or Design Consultant for all costs and expenses associated with defending such Claim or separate item, including but not limited to, attorneys' fees, audit costs, accountants' fees, expert witness' fees, additional Design Consultant expenses, additional construction management expenses, or services and any other consultant costs.

7.8.2 If the Contractor breaches any obligation under the Contract Documents, the Contractor shall reimburse the Owner and Design Consultant for all costs and expenses incurred by the Owner relating to such breach, including but not limited to attorneys' fees, audit costs, accountants' fees, expert witness' fees, additional Design Consultant expenses, additional construction management expenses, and any other consultant costs.

7.8.3 If the Owner or Design Consultant substantially prevails in a Claim brought against the Contractor, or in defending a Claim brought by the Contractor, including but not limited to,

Claims for fraud or misrepresentation, overpayment, defective work, delay damages, and recovery of termination expenses, the Contractor shall reimburse the Owner and/or Design Consultant for all costs and expenses incurred by them relating to such Claim, including but not limited to attorneys' fees, audit costs, accountants' fees, expert witness' fees, additional Design Consultant expenses, additional construction management expenses, and any other consultant costs.

ARTICLE 8

TIME

8.1 DEFINITIONS

8.1.1 Unless otherwise provided, the Contract Time is the period of time allotted in the Contract Documents for Final Completion of the Work as defined in Paragraph 8.1.4, including authorized adjustments thereto. The Contractor shall achieve Final Completion within the Contract Time.

8.1.2 The date of commencement of the Work is the date established in the Notice to Proceed. If there is no Notice to Proceed, it shall be the date of the Owner-Contractor Agreement or such other date as may be established therein. The Contractor shall not commence work or store materials or equipment on site until written Notice to Proceed is issued or until the Contractor otherwise receives the Owner's written consent.

8.1.3 The date of Substantial Completion of the Work or designated portion thereof is the date certified by the Design Consultant and the Owner when the Work or a designated portion thereof is sufficiently complete, in accordance with the Contract Documents, so the Owner can fully and legally occupy and utilize the Work or designated portion thereof for the use for which it is intended, with all of the parts and systems operable as required by the Contract Documents, including a preliminary test and balance report for the mechanical system. Only incidental corrective work and any final cleaning beyond that needed for the Owner's full use may remain for Final Completion. The Contractor acknowledges and agrees that the intercom, telephone, data security, building automation system (including functional graphics at the site), MATV, and other educational operational systems are required for the Owner’s use of the building for its intended purpose. The Contractor shall provide operation and maintenance manuals to the Owner as required by the Contract Documents prior to Substantial Completion and shall provide the required training on the operation of the equipment and systems within two weeks of Substantial Completion. The Contractor shall achieve Substantial Completion by the date specified in the Owner-Contractor Agreement including authorized adjustments thereto. The Owner’s occupancy of incomplete work shall not alter the Contractor’s responsibilities pursuant to this paragraph. Only incidental corrective work and any final cleaning beyond that needed for the Owner’s full use may remain for Final Completion. The issuance of a temporary or final certificate of occupancy shall not, in itself, constitute Substantial Completion.

8.1.4 Final Completion of the Work occurs on the date certified by the Design Consultant and the Owner when the Work is totally complete, to include punch list work, in accordance with the Contract Documents and the Owner may fully occupy and utilize the Work for the use for which it is intended. The issuance of a temporary or final certificate of occupancy shall not, in itself, constitute Final Completion.

8.1.5 The term Day as used in the Contract Documents shall mean calendar day unless otherwise

specifically designated. All dates shall mean midnight of the indicated day unless otherwise stipulated.

8.1.6 Completion Dates shall mean the dates set forth in the Owner-Contractor Agreement for Substantial Completion and Final Completion.

8.2 PROGRESS AND COMPLETION

8.2.1 All time limits stated in the Contract Documents are of the essence of the Contract with respect to the Contractor's performance.

8.2.2 The Contractor shall begin the Work on the date of commencement as defined in Paragraph 8.1.2. He shall carry the Work forward expeditiously with adequate forces and shall achieve Substantial Completion and Final Completion within the time frames stated in the Contract Documents.

8.2.3 Attention is directed to the fact that the Work is urgently needed by the Owner; for this reason, it shall be agreed that the Contractor and its Subcontractors will achieve Substantial Completion of the Work under the Contract within the time established in the Owner-Contractor Agreement after award of Contract, or Notice to Proceed, and that he will achieve Final Completion of the Work in all its details for final acceptance within the time established in the Owner-Contractor Agreement.

8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 The time during which the Contractor or any of the Subcontractors is delayed in the performance of the Work by the issuance of any required permits, acts of god, excessive inclement weather, fires, floods, epidemics, quarantine restrictions, strikes, riots, civil commotions or freight embargoes, or other conditions beyond the Contractor's or the Subcontractors' control and which the Contractor or the Subcontractors could not reasonably have foreseen and provided against, except for delays caused solely by the Owner, Design Consultant or their consultants, shall be added to the time for completion of the Work stated in the Contract. Neither the Owner nor the Design Consultant shall be obligated or liable to the Contractor or the Subcontractors for indirect or direct damages, costs or expenses of any nature which the Contractor, the Subcontractors, or any other person may incur as a result of any of the delays, interferences, changes in sequence in the Work included in this Section 8.3.1. The Contractor hereby expressly waives any Claims against the Owner and the Design Consultant on account of any indirect or direct damages, lost profits, costs or expenses of any nature which the Contractor, the Subcontractors or any other person may incur as a result of any delays, interferences, changes in sequence or the like, and it is understood and agreed that the Contractor's sole and exclusive remedy in any such events shall be an extension of the Contract time in accordance with the Contract Documents.

8.3.2 In the event Project delays arise from or out of any act or omission of the Owner, Design Consultant or their consultants, the time during which the Project is delayed shall be added to the Contract and the Contractor may be reimbursed for its direct Project damages, excluding general overhead expenses and indirect costs, if the Contractor strictly complies with this Article 8.3. Notwithstanding the previous sentence, if the Contractor or Subcontractor in any way shares in responsibility for the delay, neither the Owner nor the Design Consultant shall be obligated or liable to the Contractor or the Subcontractors for indirect or direct damages, costs or expenses of any nature which the Contractor, the Subcontractors, or any other person may

incur as a result of any of the delays, interferences, changes in sequence of the Work, and the Contractor's sole remedy, if any, shall be an extension of the Contract time.

8.3.3 In the event Project delays arise solely from or out of any act or omission of the Contractor, Subcontractors or their agents, the Contractor shall not be entitled to extension of the Contract time and shall be subject to the payment of Liquidated Damages as provided in this Contract.

8.3.4 The Contract time shall be adjusted only for changes pursuant to section 12.1, suspension of the Work pursuant to paragraph 3.3.2 or paragraph 3.3.3, and excusable delays pursuant to paragraph 8.3.4. In the event the Contractor requests an extension of the Contract time or files a Claim related to any form of delay, it shall furnish such justification and supporting evidence as the Owner may deem necessary for a determination of whether or not the Contractor is entitled to an extension of time under the provisions of the Contract, and shall further conform to all of the requirements of the Specifications sections for construction schedules. The burden of proof to substantiate a Claim shall rest with the Contractor, including evidence that the cause was beyond its control. The Owner shall base its findings of fact and decision on such justification and supporting evidence, including a finding that the alleged delay impacted the Project's critical path, and shall advise the Contractor in writing thereof. If the Owner finds that the Contractor is entitled to any extension of the Contract time, the Owner's determination of the total number of days of extension shall be based upon the currently approved progress schedule and on all data relevant to the extension. Such data will be incorporated into the schedule in the form of a revision thereto, accomplished in a timely manner. The Contractor acknowledges and agrees that actual delays (due to said changes, suspension of Work or excusable delays) in activities which, according to the schedule, do not affect the Contract time, do not have any effect upon the Contract time and therefore will not be the basis for a change therein. The Contractor acknowledges and agrees that time extensions will be granted only to the extent that excusable delays exceed the available float in the critical path activities in the Contractor's currently approved schedule.

8.3.4.1 Extensions in the Contract time by Change Orders are subject to extension-in-time audit by the Owner as follows:

8.3.4.1.1 The Contractor agrees that, even though the Owner, Contractor and Design Consultant have previously signed a Change Order containing an extension-in-time resulting from a change in or addition to the Work that said extension in the Contract time may be adjusted by an audit after the fact by the Owner. If such an audit is to be made, the Owner must undertake the audit and make a ruling within thirty (30) days after the completion of the Work under the Change Order.

8.3.4.1.2 The Contractor agrees that any extension of the Contract time to which it is entitled arising out of a Change Order undertaken on a force accounting (labor and materials) basis, shall be determined by an extension-in-time audit by the Owner after the Work of the Change Order is completed. Such rulings shall be made by the Owner within thirty (30) days after a request for same is made by the Contractor or Design Consultant, except said thirty (30) days will not start until the Work under the Change Order is completed.

8.3.4.1.3 Should a time extension be granted for Substantial Completion the date for Final Completion shall be appropriately adjusted unless specifically stated otherwise.

8.3.4.2 Subject to other provisions of the Contract, the Contractor may be entitled to an extension of the Contract time (but no increase in the Contract sum) for delays arising from unforeseeable causes

beyond the control and without the fault or negligence of the Contractor, the Subcontractors or suppliers as follows:

8.3.4.2.1 Labor disputes and strikes (including strikes affecting transportation), that do, in fact, directly delay the progress of the Work on the critical path; however, an extension of Contract time on account of an individual labor strike shall not exceed the number of days of said strike;

8.3.4.2.2 Acts of nature: tornado, fire, hurricane, blizzard, earthquake, or flood that damage Work in place or stored materials or adversely impact the schedule's critical path;

8.3.4.2.3 Excessive inclement weather; however, the Contract time will not be extended due to reasonably anticipated inclement weather or for delays in the aftermath of inclement weather, reasonably anticipated or excessive. The time for performance of this Contract, as stated in the Contract Documents, includes an allowance for calendar days which may not be available for construction out-of-doors; for the purposes of this Contract, the Contractor agrees that the number of calendar days per month stated below are cumulatively to be considered reasonably anticipated inclement weather and planned for in the construction schedule per the Specifications sections for construction schedules. Unless the Contractor can substantiate to the satisfaction of the Owner that there was greater than the reasonably anticipated cumulative inclement weather considering the time from the notice-to-proceed with on-site activities until the date established for Substantial Completion using data from the national weather service station at ILM Airport, Wilmington, North Carolina, or a weather station acceptable to the Owner and that such alleged greater than reasonably anticipated cumulatively inclement weather actually delayed the Work or portions thereof which had an effect upon the Contract time, the Contractor shall not be entitled to an extension of time.

For the purpose of this Contract, the Contractor agrees to anticipate and plan for cumulatively inclement weather for the number of calendar days in accordance with the following table:

	Planned days/month
Jan	8
Feb	8
Mar	8
Apr	7
May	8
Jun	8
Jul	10
Aug	9
Sep	8
Oct	6
Nov	7
Dec	8

Also the Contractor agrees that the calculation of the number of excessive inclement weather days shall be the total number of days in excess of those shown for the relative cumulative months in the table above, in which precipitation exceeded one tenth (.10) inch, or in which the highest temperature was 32 degrees F or less as recorded at the approved weather station. Rain days from hurricanes and tropical storms not causing damage in the county in which the project is located shall be deemed inclement weather days.

If the total accumulated number of calendar days lost to excessive inclement weather, from the notice-to-proceed with on-site activities until the date established for Substantial Completion, exceeds the total accumulated number to be reasonably anticipated for the same period from the table above, time for completion will be extended by the number of calendar days needed to include the excess number of calendar days lost. No extension of time will be made for days due to excessive inclement weather occurring after date established for Substantial Completion. No change in Contract sum will be authorized because of adjustment of Contract time due to excessive inclement weather; and

8.3.4.2.4 Delays in the issuance of the building permit required for construction of the Project, acts of the public enemy, acts of the State, Federal or local government in its sovereign capacity, and acts of another Contractor in the performance of a Contract with the Owner relating to the Project.

8.3.5 If the Contractor shall neglect, fail or refuse to complete the Work within the time herein specified, or any proper extension thereof granted by the Owner, then the Contractor does hereby agree, as a part consideration for the awarding of this Contract, to pay the Owner the amount specified in the Contract, not as a penalty but as Liquidated Damages for such breach of Contract as hereinafter set forth, for each and every calendar day that the Contractor shall be in default after the time stipulated in the Contract for completing the Work. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current periodical estimates.

8.3.6 The Contractor and the Subcontractors shall not be entitled to and hereby expressly waive any extension of time resulting from any condition or cause unless said Claim for extensions of time is made in writing to the Owner within ten (10) days of the first instance of delay for all delays, except excessive inclement weather which shall be made in writing to the Owner within forty-five (45) days after the date established for Substantial Completion. Circumstances and activities leading to such Claim shall be indicated or referenced in a daily field inspection report for the day(s) affected. In every such written Claim, the Contractor shall provide the following information:

8.3.6.1 Nature of the delay;

8.3.6.2 Date (or anticipated date) of commencement of delay;

8.3.6.3 Activities on the progress schedule affected by the delay, and/or new activities created by the delay and their relationship with existing activities;

8.3.6.4 Identification of person(s) or organization(s) or event(s) responsible for the delay;

8.3.6.5 Anticipated extent of the delay; and

8.3.6.6 Recommended action to avoid or minimize the delay.

8.3.7 If no schedule or agreement is made stating the dates upon which written interpretations as set forth in Section 2.2 shall be furnished, then no Claim for delay shall be allowed on account of failure to furnish such interpretations until twenty (20) days after request is made for them, and not then unless such Claim is reasonable.

8.3.8 No Claim by the Contractor for an extension of time for delays will be considered unless made in strict compliance with the requirements of this Article. All Claims not filed in accordance with this paragraph shall be waived by the Contractor.

8.4 RESPONSIBILITY FOR COMPLETION

8.4.1 The Contractor shall be responsible for completion in accordance with Paragraph 4.12.1.

8.4.2 The Owner may require the Contractor to submit a recovery schedule in accordance with Specifications sections for construction schedules demonstrating his program and proposed plan to make up the lag in scheduled progress and to ensure completion of the Work within the Contract Time. If the Owner finds the proposed plan not acceptable, he may require the Contractor to submit a new plan. If the actions taken by the Contractor or the second plan proposed are not satisfactory, the Owner may require the Contractor to take any of the actions set forth in Paragraph 4.12.2 without additional cost to the Owner, to make up the lag in scheduled progress.

8.4.3 Failure of the Contractor to substantially comply with the requirements of this Section 8.4 may be considered grounds for a determination by the Owner, pursuant to Section 14.3, that the Contractor is failing to prosecute the Work with sufficient diligence to ensure its completion within the Contract Time.

8.5 LIQUIDATED DAMAGES FOR DELAY

8.5.1 Owner and Contractor agree that the damages incurred by the Owner due to the Contractor's failure to achieve Substantial Completion by the date specified in the Owner-Contractor Agreement for Substantial Completion, including any extensions thereof, shall be in the amounts set forth in the Owner-Contractor Agreement, for each consecutive day beyond the date of Substantial Completion that Contractor achieves Substantial Completion, and that the damages incurred by the Owner due to the Contractor's failure to achive Final Completion by the date specified in the Owner-Contractor Agreement for Final Completion, including any extensions thereof, shall be in the amount set forth in the Owner-Contractor Agreement for each consecutive day beyond the date of Final Completion that Contractor achieves Final Completion. The Liquidated Damages are a reasonable estimate by Contractor and Owner of the damages to be suffered by Owner and are not to be construed as a penalty, it being recognized by the Owner and the Contractor that the injury to the Owner which could result from a failure of the Contractor to complete on schedule is uncertain and cannot be computed exactly or that it would be unreasonably expensive for Owner to calculate its damages exactly.

8.5.2 The amount specified for Substantial Completion is the minimum measure of damages the Owner will sustain due to delay in the completion of the Work, which shall inlcude, but not be limited to the loss of use of the facilities, the relocation of students and services, the cost of the Owner’s time and resourses, damage to the Owner’s reputation, and storage of furniture and other materials. The amount specified for Final Completion is a reasonable and proper measure of the damages the Owner will sustain due to the delay in the completion of remedial work. This amount includes the disruption to the school and the learning environment, the cost of the Owners time and resources, damage to the Owner’s reputation, and the inability to fully use the facilities. The inability of the Owner to quantify actual damages shall not prevent the recovery of Liquidated Damages.

8.5.3 Not withstanding any other provisions of these General Conditions, if there is concurrent delay

in the completion of the Work, the Contractor shall be liable for Liquidated Damages as specified in the General Conditions and Owner-Contractor Agreement during such period of concurrent delay. For the purpose of this Paragraph, concurrent delay means (a) a delay event caused in part by the Owner or its agent and in part by the Contractor or its agents, Subcontractors or Sub-subcontractors, or (b) one or more delay event caused solely by the Owner, its agents, or the Design Consultant, and one or more delay event caused in part by the Contractor, its agents, Subcontractors or Sub-subcontractors, each of which would have resulted in a delay without the other and which delays run concurrently, or at the same time. In the event that the foregoing provision making the Contractor liable for Liquidated Damages during a period of concurrent delay is found to be unenforcable, then the parties agree that in the event of a concurrent delay, the extent of the delay will be apportioned between the Owner and the Contractor, and the Contractor will be responsible for Liquidated Damages as set forth in the General Conditions and Owner-Contractor Agreement for those portions of the delay which are apportioned to the Contractor, its agent, Subconctractors, Sub-subcontractors, or Material Suppliers.

8.5.4 The provisions for Liquidated Damages do not bar or limit Owner's other rights and remedies against Contractor, for damages other than for failure to achieve the Substantial Completion date or the Final Completion date as required. The amount of Liquidated Damages set forth in Section 8.5 shall not include additional legal or design professional costs that may result from the Contractor's default. If such legal or design professional costs are incurred by the Owner, the Contractor shall be liable to the Owner for those costs in addition to the Liquidated Damages amount set forth in Section 8.5.

8.5.5 The Liquidated Damages assessed for failure to meet Substantial Completion by the specified date and the Liquidated Damages assessed for failure to meet Final Completion by the specified date shall be assessed cumulatively.

ARTICLE 9

PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

9.1.1 The Contract Sum is stated in the Owner-Contractor Agreement and, including authorized adjustments thereto, is the total amount payable by the Owner to the Contractor for the performance of the Work under the Contract Documents.

9.2 SCHEDULE OF VALUES

9.2.1 Before the first Application for Payment, the Contractor shall submit to the Owner a schedule of values allocated to the various portions of the Work, as set forth in the Specifications sections for construction schedules, and supported by such data to substantiate its accuracy as the Owner may require. This schedule, unless objected to by the Owner, shall be used as a basis for the Contractor's Applications for Payment and only for this purpose. If approved by the Owner, the Contractor may include in his schedule of values a line item for mobilization which shall include a reasonable amount of mobilization for the Contractor and his Subcontractors. The Contractor shall not front-end load his schedule of values.

9.3 APPLICATIONS FOR PAYMENT

9.3.1 Prior to the date for each progress payment established in the Owner-Contractor Agreement, the Contractor, in accordance with the Specifications sections for construction schedules, shall submit to the Design Consultant an itemized Application for Payment, notarized if required, supported by such data substantiating the Contractor's right to payment as the Design Consultant and the Owner may require, including but not limited to the Contractor's certification that all work for which payment is requested has been completed in full in accordance with the Contract Documents, and reflecting retainage, if any, as provided elsewhere in the Contract Documents. If requested by the Owner, the Contractor shall also certify that he has paid all due and payable amounts for which previous Applications for Payment were issued and payments received from the Owner, by providing waivers of liens for said payments.

9.3.1.1 The Contractor shall submit with the Application for Payment a list of those minority and Historically Underutilized Businesses (HUBs) Subcontractors whose work is included in the application and the amount due each. In addition, the minority and Historically Underutilized Business (HUBs) must itself perform satisfactory work or services or provide supplies under the Contract and not act as a mere conduit.

9.3.2 The Owner will withhold retainage from Contractor on all Applications for Payment to the maximum extent and in the maximum amount allowed by law (currently codified at N.C.G.S. 143-134.1) and in accordance with that statute or applicable successor statute. In the event that N.C.G.S 143-134.1 or applicable successor statute are not in effect or do not apply at the time the Contract is executed, Owner will retain five percent (5%) of the amount of each Application for Payment from the Contractor as retainage, until Contractor achieves Final Completion, whether or not the Owner has occupied any or all of the Project before such time. However, if the Owner, at any time after fifty percent (50%) of the Work has been completed, finds that satisfactory progress is being made, he may authorize payment to the Contractor in full of each Progress Payment for work performed beyond the fifty percent (50%) stage of completion. If a reduction in retainage has been made, the Owner may increase the retainage back to original percentage at any time if the Owner concludes that the Contractor is not progressing with the Work in a timely or satisfactory manner.

9.3.3 Payments may be made by the Owner, at its sole discretion, on account of materials or equipment not incorporated in the work but delivered and suitably stored at the site or in a bonded warehouse by the Contactor. Payments for materials or equipment stored shall only be considered upon submission by the Contractor of satisfactory evidence (for example, releases or paid invoices from the seller) that the Contractor has acquired title to such material, that it will be utilized on the work under this Contract and that it is satisfactorily stored, protected, and insured or that other procedures satisfactory to the Owner that will protect the Owner's interests have been taken. In the event the materials are stored in a bonded warehouse that is not located in the county of the project, the Contractor shall reimburse the travel cost and hourly billing expenses incurred by the Design Consultant for travel to view and assess whether the materials meet the requirements of the Contract Documents. Materials once paid for by the Owner become the property of the Owner and may not be removed from the work site or bonded warehouse, other than to be delivered from the warehouse to the site, without the Owner's written permission. Responsibility for such stored materials and equipment shall remain with the Contractor regardless of ownership.

9.3.3.1 Owner will not make payment to the Contractor on account of materials or equipment not incorporated in the Work but delivered and stored at the site if the Contractor, in his schedule of values, does not includes line items for such delivered and stored materials or equipment.

9.3.3.2 It is specifically understood and agreed that an inspection and approval of the materials by the Owner, the Design Consultant or any agency retained by any of them shall not in any way subject the Owner to pay for the said materials or any portion thereof, even though incorporated in the Work, if said materials shall in fact turn out to be unfit to be used in the Work, nor shall such inspection be considered as any waiver of objection to the Work on account of the unsoundness or imperfection of the material used.

9.3.4 The Contractor warrants that title to all work, materials and equipment covered by an Application for Payment will pass to the Owner either by incorporation in the construction or upon the receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances, hereinafter referred to in this Article 9 as "liens"; and that no work, materials or equipment covered by an Application for Payment will have been acquired by the Contractor, or by any other person performing work at the site or furnishing materials and equipment for the Project, subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or such other person.

9.3.5 The Contractor shall submit with the Application for Payment a notarized Contractor's Sales Tax Report of N.C. State Appendix B and County sales taxes paid during the payment period with respect to building materials, supplies, fixtures, and equipment that have become a part of, or annexed to, a building or structure erected, altered or repaired for the Owner. The Sales Tax Report shall include the vendor from whom the property was purchased, the dates and number of invoices covering the purchase, the total amount of the invoices of each vendor, the North Carolina State and County sales and use tax paid thereof, and the cost of the property withdrawn from the warehouse stock and North Carolina sales or use taxes paid thereof. Items that should not be included are: scaffolding, forms for concrete, fuel for operation of machinery and equipment, tools, equipment, equipment repair parts and equipment rentals.

9.3.6 Unless an interest rate is required by law, Owner shall not pay any interest on an amount owed to Contractor. No interest shall accrue on amounts Owner is authorized by law or by the Contract to withhold or backcharge to Contractor.

9.3.7 The following conditions shall apply to the Contractor billing for the use of allowances contained in the Contract documents:
.1 An Allowance Expenditure Form (sample attached as Appendix C) shall be approved by the Contractor, Owner and Design Consultant prior to submitting an Application for Payment including payment for all or part of an allowance; and
.2 The Contractor shall provide documentation similar to that required to support a Change Order pursuant to Article 10 for each Allowance Expenditure Form

9.4 CERTIFICATION OF PAYMENT

9.4.1 The Design Consultant will, after receipt of the Contractor's Application for Payment either issue a Certification of Payment to the Owner, with a copy to the Contractor, for such amount as the Design Consultant determines is properly due, or notify the Contractor in writing of their reasons for withholding a Certification as provided in Paragraph 9.6.1.

9.4.2 The submission and approval of the progress schedule and monthly updates thereof as required by the Specifications sections for construction schedules, shall be an integral part and basic element of the application upon which progress payment shall be made. The Contractor shall be entitled to progress payments only as determined from the currently approved and updated

schedule.

9.4.3 The signing of a Certification of Payment will constitute a representation by the Design Consultant to the Owner, based on their observations at the site pursuant to their agreements with the Owner, and the data comprising the Application for Payment, that the Work has progressed to the point indicated; that, to the best of their knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to the results of any subsequent tests required by or performed under the Contract Documents, to minor deviations from the Contract Documents correctable prior to completion, and to any specific qualifications stated in their Certification); and that the Contractor is entitled to payment in the amount certified. However, by signing a Certification of Payment, the Design Consultant shall not thereby be deemed to represent that it has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work or that it has reviewed the construction means, methods, techniques, sequences, or procedures, or that it has made any examination to ascertain how or for what purpose the Contractor has used the moneys previously paid on account of the Contract Sum.

9.5 PROGRESS PAYMENTS

9.5.1 After a Certification of Payment has been issued, the Owner shall make payment in the manner and within the time provided in the Contract Documents, unless Contractor is in breach of the Contract or otherwise owes the Owner, in which case Owner may withhold an appropriate amount.

9.5.2 The Contractor shall promptly pay each Subcontractor (including suppliers, laborers, and material-men) performing labor or furnishing material or equipment for the Work, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's work, the amount to which said Subcontractor is entitled, reflecting the percentage actually retained, if any, from payments to the Contractor on account of such Subcontractor's work. The Contractor shall, by an appropriate agreement with each Subcontractor, also require each Subcontractor to make payments to his Sub-subcontractors in similar manner. The Owner may at any time require proof of payment to a Subcontractor or Sub-subcontractor for work paid by the Owner. Notwithstanding any other provision of the General Conditions, no Contractor, Subcontractor, Sub-subcontractor or Material Supplier shall have any Claim against the Owner, by virtue of the Contract, under any theory, including breach of contract, or third party beneficiary. The Owner shall not be in privy of any contract with any Subcontractor, Sub-subcontractor or Material Supplier pertaining to the Work, the Project and these General Conditions. Also, neither the Contractor, or any Subcontractor or Sub-subcontractor shall have any right to assert a lien on Owner’s real property or on any funds held by Owner.

9.5.3 The Owner may, on request and at his discretion, furnish to any Subcontractor, if practicable, information regarding the percentages of completion or the amounts applied for by the Contractor and the action taken thereon by the Design Consultant on account of work done by such Subcontractor.

9.5.4 Neither the Owner nor the Design Consultant shall have any obligation to pay or to see to the payment of any moneys to any Subcontractor except as may otherwise be required by law.

9.5.5 No Certification for a progress payment, nor any progress payment or final payment, nor any partial or entire use or occupancy of the Project by the Owner, shall constitute an acceptance of

any Work not in accordance with the Contract Documents.

9.5.6 The Contractor agrees to keep the Work and the site of the Project free and clear of all liens related to labor and materials furnished in connection with the Work. Furthermore, pursuant to and in compliance with requirements of Paragraph 9.3.4, the Contractor waives any right he may have to file any type of lien in connection with the Work. Notwithstanding anything to the contrary contained in the Contract Documents, if any such lien is filed or there is evidence to believe that any lien may be filed at any time during the progress of the Work or within the duration of this Contract, the Owner may refuse to make any payment otherwise due the Contractor or may withhold from any payment due the Contractor a sum sufficient in the opinion of the Owner to pay all obligations and expenses necessary to satisfy such lien or the underlying claim represented by such lien. The Owner may withhold such payment unless or until the Contractor, within ten (10) days after demand thereof by the Owner, shall furnish satisfactory evidence that the indebtedness and any lien in respect thereof has been satisfied, discharged and released of record, or that the Contractor has legally caused such lien to be released of record pending the resolution of any dispute between the Contractor and the person or persons filing such lien. If the Contractor shall fail to furnish such satisfactory evidence within ten (10) days of the demand thereof, the Owner may discharge such indebtedness and deduct the amount thereof, together with any and all losses, costs, damages and attorney's fees suffered or incurred by the Owner from any sum payable to the Contractor under the Contract Documents, including but not limited to final payment and retained percentage. This Paragraph 9.5.6 shall be specifically included in all Subcontracts and purchase orders entered into by the Contractor. Notwithstanding any other provision of the Contract, nothing in the Contract shall affect the rights of Subcontractors, Sub-subcontractors, Material Suppliers and Vendors from enforcing any lien rights they have against parties other than the Owner.

9.6 PAYMENTS WITHHELD

9.6.1 The Design Consultant may decline to certify payment and may withhold their Certification of Payment in whole or in part, to the extent necessary to reasonably protect the Owner, if in the Design Consultant's opinion it is unable to make representations to the Owner as provided in Paragraph 9.4.3. If the Design Consultant is unable to make representations to the Owner as provided in Paragraph 9.4.3 and to certify payment in the amount of the Application for Payment, it will notify the Contractor as provided in Paragraph 9.4.1. If the Contractor and the Design Consultant cannot agree on a revised amount, the Design Consultant will promptly issue a Certification of Payment for the amount for which it is able to make such representations to the Owner. The Design Consultant may also decline to certify payment because of subsequently discovered evidence or subsequent observations that may nullify the whole or any part of any Certification of Payment previously issued to such extent as may be necessary in its opinion to protect the Owner from loss, because of:

.1 Defective Work not remedied,

.2 Third party claims filed, whether in court, in arbitration or otherwise, or reasonable evidence indicating probable filing of such claims,

.3 Failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment,

.4 Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum,

.5 Damage to the Owner or another contractor,

.6 Reasonable evidence that Contractor will not achieve Substantial Completion and/or Final Completion by the dates specified in the Owner-Contractor Agreement.

.7 Failure or refusal of the Contractor to carry out the Work in accordance with or to otherwise substantially or materially comply with the Contract Documents,

.8 Liens filed or reasonable evidence that a lien may be filed for any portion of the Work,

.9 Failure or refusal of the Contractor to properly schedule and coordinate the Work, to provide progress schedules, reports and updates, or to otherwise fully comply with the Specifications sections for construction schedules,

.10 Failure or refusal of the Contractor to fully comply with the provisions of Section 6.2 requiring the Contractor to direct certain Claims to Separate Contractors and to defend and indemnify the Owner and/or the Design Consultant in the event Separate Contractors file certain Claims, or

.11 Failure or refusal of the Contractor to submit the required information on minority and Historically Underutilized Businesses (HUBs)

.12 Failure or refusal of the Contractor to submit a notarized North Carolina State and County Sales Tax Report.

.13 Any other breach of the Contract by Contractor which has or is likely to cause monetary damages or loss to Owner.

.14 Any other reason authorized by the Contract Documents or by law.

9.6.2 When the above grounds in Paragraph 9.6.1 are removed to the Design Consultant's and Owner's satisfaction, payment shall be made for amounts withheld because of them.

9.7 FAILURE OF PAYMENT

9.7.1 If the Owner does not make payment to the Contractor within the forty-five (45) calendar days after receipt of the Contractor's approved Application for Payment from the Design Consultant through no fault of the Contractor, and the Owner otherwise not being entitled under the Contract Documents or applicable law to withhold payment, then the Contractor may, upon seven (7) additional days' Notice to the Owner, stop the Work until payment of the amount owed according to the Contract Documents has been received. In such event, the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, which shall be effected by appropriate Change Order as provided herein.

9.8 SUBSTANTIAL COMPLETION

9.8.1 When the Contractor considers that the Work, or a designated portion thereof which is acceptable to the Owner, is substantially complete as defined in Paragraph 8.1.3, the Contractor shall prepare for submission to the Owner a list of items which in his opinion are to be completed or corrected and shall request in writing that the Design Consultant and the Owner perform a Substantial Completion inspection. The Design Consultant and the Owner shall review the Contractor's list and shall compile a punch list of items to be corrected and completed. The

failure to include any items on such list does not alter the responsibility of the Contractor to complete the Work in accordance with the Contract Documents. When the Design Consultant and the Owner on the basis of an inspection jointly determine that the Work or designated portion thereof is substantially complete, they will then prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall state the responsibilities of the Owner and the Contractor for security, maintenance, heat, utilities, damage to the Work, and insurance, and shall fix the time within which the Contractor shall complete the items listed therein. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in such Certificate.

9.8.2 Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Design Consultant, the Owner shall make payment, except retainage held pursuant to Paragraph 9.3.2, for such work or portion thereof, as provided in the Contract Documents unless Contractor is in breach of the Contract in which case Owner may withhold an appropriate amount.

9.8.3 The acceptance of Substantial Completion payment shall constitute a waiver of all Claims by the Contractor and its Subcontractors and Sub-subcontractors except those previously made in writing and identified by the Contractor as unsettled at the time the Contractor submits the Application for Payment for Substantial Completion, and except for the retainage sums due at Final Completion. The Contractor shall indemnify and hold the Owner harmless against any Claims by its Subcontractors and Sub-subcontractors that are waived because they were not made in writing and identified by the Contractor as unsettled when the Contractor submitted the Application for Payment for Substantial Completion.

9.8.4 The Owner shall have the option to correct or conclude any and all punch list items not completed by the Contractor to the satisfaction of the Design Consultant and the Owner within thirty (30) days from the actual date of Substantial Completion by utilizing its own forces or by hiring others. The cost of such correction of remaining punch list items by the Owner or others shall be deducted from the final payment to the Contractor. If Contractor does not complete certain punch list items within this time period, specified in Paragraph 9.8.4, all warranties and guarantees for such incomplete punch list items shall become effective upon issuance of final payment for the Project. Paragraph 9.8.4 does not limit the Liquidated Damages provisions related to failure to reach Final Completion by the date stipulated in the Contract Documents.

9.8.5 The issuance of the Certificate of Substantial Completion does not indicate final acceptance of the Project by the Owner, and the Contractor is not relieved of any responsibility for the Project except as specifically stated in the Certificate of Substantial Completion.

9.8.6 Should the Design Consultant and the Owner determine that the Work or a designated portion thereof is not substantially complete, they shall inform the Contractor in writing stating why the Project or designated portion is not substantially complete. The Contractor shall expeditiously complete the Work and shall re-request in writing that the Design Consultant and the Owner perform a Substantial Completion inspection. Costs, if any, associated with such inspection shall be assessed to the Contractor.

9.8.7 Certificate of Substantial Completion will not be issued until the following is completed by Contractor:

.1 Submit Contractor's list of work not yet complete with proposed time for completion signed by Contractor's project superintendent;

.2 Submit Certificate of Occupancy;

.3 Submit record drawings, maintenance manuals, final project photos, property surveys;

.4 Deliver tools, spare parts, extra stock and similar items;

.5 Submit warranties, bonds, maintenance agreements and final certifications;

.6 Complete start-up testing of all systems and instruction of the Owner's personnel;

.7 Coordinate and complete final changeover of permanent locks and transmit keys to Owner;

.8 Discontinue and remove temporary facilities from the site;

.9 Complete final cleaning;

.10 Advise the Owner of pending insurance changeover requirements;

.11 Coordinate and complete changeover of security, telephone, cable and other services; and

.12 Submit pay application showing 100% complete for work claimed to be substantially complete.

9.8.8 The Contractor acknowledges that the Design Consultant and its consultants are only required to conduct up to two (2) comprehensive substantial completion inspections as part of its basic services. If more than two (2) substantial completion inspections are required through no fault of the Design Consultant, the cost of the additional inspections shall be paid by the Contractor.

9.9 FINAL COMPLETION AND FINAL PAYMENT

9.9.1 Upon receipt of the documentation required by Section 9.8, and of written Notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Design Consultant and the Owner will promptly make such inspection and, when they find the Work acceptable under the Contract Documents and the Contract fully performed, the Design Consultant shall issue a final Certification of Payment stating that to the best of their knowledge, information and belief, and on the basis of their observations and inspections, the Work has been completed in accordance with the terms and conditions of the Contract Documents. The final Certification of Payment will constitute that the conditions precedent to the Contractor's being entitled to final payment as set forth in Section 9.8 have been fulfilled. Payment shall be made to the Contractor in the amount certified by the Design Consultant within forty five (45) calendar days after receipt by the Owner of the final Certification of Payment except for any Work for which the Owner is entitled a credit under the Contract Documents.

9.9.1.1 The Contractor acknowledges that the Design Consultant and its consultants are only required to conduct up to two (2) comprehensive final completion inspections as part of its basic services. If more than two (2) final completion inspections are required through no fault of the Design Consultant, the cost of the additional inspections shall be paid by the Contractor.

9.9.2 Neither the final payment nor the remaining retained percentage shall become due until the

Work is free and clear of any and all liens and the Contractor submits to the Owner:

.1 An affidavit that all payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or his property might in any way be responsible, have been paid or otherwise satisfied;

.2 Consent of Surety to final payment;

.3 If required by the Owner, other data establishing payment or satisfaction of all such obligations, such as receipts, releases and waivers of liens arising out of the Contract, to the extent and in such form as may be designated by the Owner; and

.4 A written certification that:

.1 The Contractor has reviewed the requirements of the Contract Documents,

.2 The Work has been inspected by the Contractor for compliance with all requirements of the Contract Documents,

.3 Pursuant to this inspection, the Contractor certifies and represents that the Work complies in all respects with the requirements of the Contract Documents,

.4 The Contractor further certifies and represents that all equipment and systems have been installed in accordance with the Contract Documents and have been tested in accordance with the Specification requirements and are operational, and

.5 The Contractor hereby certifies and represents that the Work is complete in all respects and ready for final inspection.

9.9.3 If any Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify him against any loss. If any such lien or claim remains unsatisfied after all payments are made, the Contractor shall refund to the Owner all moneys that the latter may be compelled to pay in discharging such lien or claims, including all costs and reasonable attorney's fees. The Owner may withhold from the final payment any sum that the Owner has reason to believe may be needed to satisfy any lien, claim or threat of lien arising from the Work. The Owner may deduct from the final payment an amount equal to any costs, expenses and attorney's fees incurred by the Owner in removing or discharging any liens or claim arising from the Work.

9.9.4 If, after Substantial Completion of the Work, Final Completion thereof is materially delayed through no fault of the Contractor or by the issuance of Change Orders affecting Final Completion, and the Owner so confirms, the Owner shall, upon application by the Contractor and certification by the Design Consultant, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for the portion of the Work not fully completed or corrected is less than the retainage stipulated in the Contract Documents, and if bonds have been furnished as provided in Section 7.4, the written consent of the Surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Design Consultant prior to certification of such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

9.9.5 The making of final payment shall constitute a waiver of all Claims by the Owner against the

Contractor except those arising from:

.1 Unsettled liens, and claims against the Owner or the Design Consultant, or their employees, agents, or representatives;

.2 Faulty, defective or non-conforming Work;

.3 Failure of the Work to comply with the requirements of the Contract Documents;

.4 Terms of any warranties contained in or required by the Contract Documents;

.5 Damages incurred by the Owner resulting from lawsuits brought against the Owner, the Design Consultant, or their agents, employees or representatives because of failures or actions on the part of the Contractor, his Subcontractors, Sub-subcontractors, or any of their employees, agents or representatives;

.6 Fraud or bad faith committed by the Contractor or any Subcontractor or supplier during performance of the Work but discovered by Owner after final payment; or

.7 Claims about which Owner did not have actual knowledge or which increase in scope or amount at the time of final payment.

9.9.6 The acceptance of final payment shall constitute a waiver of all Claims by the Contractor except those previously made in writing and identified by the Contractor as unsettled at the time of the final Application for Payment.

9.9.6.1 Notwithstanding any other provision of the Contract, Owner may withhold from Contractor payment otherwise due, as a result of any losses, expenses costs or damages suffered or anticipated to be suffered by Owner as a result of Contractor's breach of any provision of the Contract, including but not limited to Liquidated Damages or backcharges against Contractor.

9.10 OWNER'S RIGHT TO OCCUPY INCOMPLETE WORK

9.10.1 Should the Project, or any portion thereof, be incomplete for Substantial or Final Completion at the scheduled date or dates, the Owner shall have the right to occupy any portion of the Project. In such an event, the Contractor shall not be entitled to any extra compensation on account of said occupancy by the Owner or by the Owner's use of the Project, nor shall the Contractor interfere in any way with said use of the Project. Further, in such an event, the Contractor shall not be entitled to any extra compensation on account of the Owner's occupancy and use of the Project, nor shall the Contractor be relieved of any responsibilities of the Contract including the required times of completion. Such occupancy by the Owner shall not, in itself, constitute Substantial or Final Completion.

9.10.2 If the Owner exercises his rights under the foregoing and occupies the full Project, then there shall be no Liquidated Damages on account of failure on the Contractor's part to reach Substantial Completion from that date forward. This provision does not affect, however, any Liquidated Damages that would be assessed for any period of time between the contractual date of Substantial Completion and the date of any such occupancy. Further, this provision would have no effect on Liquidated Damages assessed on account of late Final Completion.

ARTICLE 10

PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

10.1.1 The Owner, the Design Consultant, or their agents, employees or representatives are not responsible for the means, methods, techniques, sequences or procedures utilized by the Contractor, or for safety precautions and programs in connection with the Work. The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. This requirement applies continuously throughout the Contract performance, until final payment is made and all punch list and warranty work is performed properly, and is not limited to regular working hours.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 The Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

.1 All employees on the Work and all other persons who may be affected thereby;

.2 All the Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his Subcontractors or Sub-subcontractors, machinery, equipment and all hazards shall be guarded or eliminated in accordance with all applicable safety regulations; and

.3 Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and overhead or underground utilities not designated for removal, relocation or replacement in the course of construction.

10.2.2 The Contractor shall give all notices and comply with all applicable laws, ordinances, permits, rules, regulations and lawful orders of any public authority bearing on the safety or persons or property or their protection from damage, injury or loss.

10.2.2.1 The Contractor shall at all times safely guard the Owner's property from injury or losses in connection with the Contract. He shall at all times safely guard and protect his own work and adjacent property as provided by law and the Contract Documents, from damage. All passageways, guard fences, lights and other facilities required for protection by applicable safety regulations must be provided and maintained.

10.2.3 The Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent utilities.

10.2.4 When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on

such activities under the supervision of properly qualified personnel.

10.2.5 The Contractor shall promptly remedy at his own cost and expense all damage or loss to any property referred to in Subparagraphs 10.2.1.2 and 10.2.1.3 caused by the Contractor, any Subcontractor, any Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable and for which the Contractor is responsible under Subparagraphs 10.2.1.2 and 10.2.1.3, except damage or loss attributable solely to the acts or omissions of the Owner or Design Consultant or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to his obligations under Section 4.21. The Contractor shall perform such restoration by underpinning, repairing, rebuilding, replanting, or otherwise restoring as may be required or directed by the Owner, or shall make good such damage in a satisfactory and acceptable manner. In case of failure on the part of the Contractor to promptly restore such property or make good such damage, the Owner may, upon two (2) calendar days Notice, proceed to repair, rebuild or otherwise restore such property as may be necessary and the cost thereof, or a sum sufficient in the judgment of the Owner to reimburse the owners of property so damaged, will be deducted from any monies due or to become due the Contractor under the Contract.

10.2.6 The Contractor is responsible for the proper packing, shipping, handling and storage (including but not limited to shipment or storage at the proper temperature and humidity) of materials to be incorporated in the Work, so as to insure the preservation of the quality and fitness of the material for proper installation and incorporation in the Work, as required by the Contract Documents. For example, but not by way of limitation, Contractor shall, when necessary, place material on wooden platforms or other hard and clean surfaces and not on the ground and/or place such material under cover in any appropriate shelter or facility. Stored materials or equipment shall be located so as to facilitate proper inspection. Material and equipment which is delivered crated shall remain crated until ready for installation. Lawns, grass plots or other private property shall not be used for storage purposes without the written permission of the Owner or lessee unless otherwise within the terms of the easements obtained by the Owner.

10.2.6.1 It shall be the responsibility of the Contractor in his preparation of phasing schedule of work operations after consulting with the other Prime Contractors to designate areas in which each Prime Contractor may store materials. Areas designed shall meet with the approval of the Design Consultant.

10.2.7 The Contractor shall give notice in writing at least forty eight (48) hours before breaking ground, to all persons, public utility companies, owners of property having structures or improvements in proximity to site of the Work, superintendents, inspectors, or those otherwise in charge of property, streets, water pipes, gas pipes, sewer pipes, telephone cables, electric cables, railroads or otherwise, who may be affected by the Contractor's operation, in order that they may remove any obstruction for which they are responsible and have representative on site to see that their property is properly protected. Such notice does not relieve the Contractor of responsibility for all damages, claims, or defense or indemnification of all actions against Owner resulting from performance of such work in connection with or arising out of Contract.

10.2.8 The Contractor shall investigate, locate, mark and protect all utilities encountered or to be encountered while performing the Work, whether indicated on the Drawings or not. The Contractor shall maintain utilities in service until moved or abandoned. The Contractor shall exercise due care when excavating around utilities and shall restore any damaged utilities to the same condition or better as existed prior to starting the Work, at no cost to the Owner. The

Contractor shall maintain operating utilities or other services, even if they are shown to be abandoned on the Contract Drawings, in service until new facilities are provided, tested and ready for use.

10.2.9 The Contractor shall return all improvements on or about the site and adjacent property which are not shown to be altered, removed or otherwise changed to conditions which existed prior to starting the Work. The Contractor shall video record all areas or otherwise document the conditions existing at the site and in and around existing buildings prior to starting the Work. Submit documentation to the Design Consultant prior to beginning the Work.

10.2.10 The Contractor shall protect the Work, including but not limited to, the site, stored materials and equipment, excavations, and excavated or stockpiled soil or other material, intended for use in the Work, and shall take all necessary precautions to prevent or minimize damage to same or detrimental effect upon his performance or that of his Subcontractors, caused by or due to rain, snow, ice, run-off, floods, temperature, wind, dust, sand and flying debris; for example, but not by way of limitation, Contractor shall, when necessary, utilize temporary dikes, channels or pumping to carry-off divert or drain water, and shall as necessary tie-down or otherwise secure the Work and employ appropriate covers and screens.

10.2.11 The Contractor shall designate a responsible member of his organization at the site whose duty shall be the prevention of accidents and the protection of material, equipment and property. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner.

10.2.12 The Contractor shall not load or permit any part of the Work to be loaded so as to endanger its safety.

10.2.13 Notification to the Contractor by the Owner or the Design Consultant of a safety violation will in no way relieve the Contractor of sole and complete responsibility for the correctness of said violation or of sole liability for the consequences of said violation.

10.3 EMERGENCIES

10.3.1 In any emergency affecting the safety of persons or property, the Contractor shall act, at his discretion, to prevent threatened damage, injury or loss. The Contractor shall notify the Owner of the situation and all actions taken immediately thereafter. If, in the opinion of the Contractor, immediate action is not required, the Contractor shall notify the Owner of the emergency situation and proceed in accordance with the Owner's instructions. Provided, however, if any loss, damage, injury or death occurs that could have been prevented by the Contractor's prompt and immediate action, the Contractor shall be fully liable for all costs, damages, claims, actions, suits, attorney's fees and all other expenses arising therefrom or relating thereto.

ARTICLE 11

INSURANCE

11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.1 The Contractor shall purchase and maintain in companies properly licensed by the Insurance Department of the State of North Carolina and acceptable to the Owner such insurance as will protect him, the Owner, and the Owner’s agents, representatives, and employees from claims

set forth below which may arise out of or result from the Contractor's operations under the Contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

.1 Claims under workers' or workmen's compensation, disability benefit and other similar employee benefit acts (with Workmen's Compensation and Employer's Liability Insurance in amounts not less than those necessary to meet the statutory requirements of the state(s) having jurisdiction over any portion of the Work);

.2 Claims for damages because of bodily injury, sickness or disease, or death of his employees; the Contractor will require his Subcontractors to similarly provide Workmen's Compensation Insurance for all of the latter's employees;

.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;

.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person;

.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom; and

.6 Claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.

11.1.2 The insurance required by Paragraph 11.1.1 shall be primary and non-contributing to any insurance possessed or procured by the Owner, and limits of liability shall be not less than those set forth in these General Conditions of the Contract or required by law, whichever is greater.

11.1.3 The insurance required by the Contract shall include contractual liability insurance applicable to the Contractor's obligations under the Contract

11.1.4 Without limiting the above during the term of the Contract, the Contractor and each Subcontractor shall, at their own expense, purchase and maintain the following insurance with companies properly licensed by the Insurance Department of the State of North Carolina and satisfactory to the Owner.

.1 Worker's Compensation including Occupational Disease and Employer's Liability Insurance.

.1 Statutory - Amount and coverage as required by State of North Carolina Worker's Compensation laws.

.2 Employer's Liability
$1,000,000 Each Accident
$1,000,000 Policy Limit
$1,000,000 Each Employee

.2 Commercial General Liability (Occurrence Form) - The Contractor shall provide during the life of the Contract such Commercial General Liability (Occurrence Form) Insurance as shall protect him and any Subcontractor performing work under the Contract from claims

for damages for Bodily Injury including accidental death, as well as from claims for Property Damage which may arise from operations under the Contract, whether such operations be by himself or by any Subcontractor or by anyone directly or indirectly employed by either of them. This insurance shall be on the Standard Insurance Services Office, Inc. (ISO) Commercial Liability Occurrence Form or other form reasonable acceptable to Owner. The Contractor shall procure insurance coverage for direct operations, sublet work, elevators, contractual liability and completed operations with limits not less than those stated below:

.1 A Combined Single Limit for Bodily Injury, Property Damage and Personal Injury of:
Limits of Insurance
$2,000,000 General Aggregate (except Products – Completed Operations) Limit
$2,000,000 Products – Completed Operations Aggregate Limit
$1,000,000 Personal and Advertising Injury Limit
$1,000,000 Each Occurrence Limit

.3 Property Damages, including Broad Form Property Damage and Explosion, Collapse, Underground property damage coverages, and blasting, where necessary;

.4 Completed Operations Liability: Continuous coverage in force for one year after completion of the Work;

.5 Commercial Automobile Insurance, including coverage for owned, non-owned and hired vehicles - with limits not less than those stated below:

.1 A Combined Single Limit for Bodily Injury
and Property Damage of $1,000,000.

.6 Umbrella Liability Insurance: Policy to "pay on behalf of the Insured"
Limits of Liability:

.1 Contract Amount: $1,000,000-$2,000,000:
Requires Umbrella Liability Insurance Limit of $1,000,000.

.2 Contract Amount: $2,000,000 and above:
Requires Umbrella Liability Insurance Limit of $2,000,000.

11.1.5 The insurance required by Section 11.1 shall be written for not less than any limits of liability specified in the Contract Documents, or required by law, whichever is greater.

11.1.6 Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These Certificates shall contain a provision that coverages afforded under the policies will not be canceled until at least thirty (30) days' prior written Notice has been given to the Owner. Failure to provide such Notice shall not limit the liability of the Insurer, its agents or representatives.

11.1.7 All insurance policies required in this Article, except Worker's Compensation and Commercial Automobile, shall name the Owner as additional named insured for the insurance.

11.1.8 The Contractor shall not commence the Work under the Contract until he has obtained all the insurance required hereunder and such insurance has been approved by the Owner, nor shall the Contractor allow any Subcontractor to commence work on his subcontract until all similar

insurance required of the Subcontractor has been so obtained and approved. Approval of the insurance by the Owner shall not relieve or decrease the liability of the Contractor hereunder.

11.1.9 The Commercial General Liability and Workers Compensation Policies provided by the Contractor shall have endorsements waiving subrogation against the Owner.

11.2 PROPERTY INSURANCE

11.2.1 The Contractor shall purchase and at all times maintain such insurance as will protect the Contractor, the Owner, Subcontractors and Sub-subcontractors from loss or damage to the Work or property in the course of construction, including all machinery, materials and supplies on the premises or in transit thereto and intended to become a part of the finished Work until Final Completion. This insurance shall be in the form of "Builders Risk Covered Cause of Loss Form", or equivalent form, to include but not limited to theft, collapse, earth movement, flood, and portions of the Work stored on site, off site and in transit. Any deductible provision in such insurance shall not exceed ten thousand dollars ($10,000). Notwithstanding any such deductible provision, the Contractor shall remain solely liable for the full amount of any item covered by such insurance. Such insurance shall be in the initial Contract Sum and shall be increased at Contractor's expense in the amount of all additions to the Contract Sum. Such insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

11.2.2 Any loss insured under Paragraph 11.2.1 is to be adjusted with the Owner and made payable to the Owner as trustee for the insureds, as their interests may appear, subject to the requirements of Paragraph 11.2.4. The Contractor shall pay each Subcontractor a just share of any insurance moneys received by the Contractor, and by appropriate agreement, written where legally required for validity, shall require each Subcontractor to make payments to his Sub-subcontractors in similar manner.

11.2.3 The Owner and Contractor waive all rights against each other for damages caused by fire or other perils to the extent their Claims are covered by insurance obtained pursuant to this Section 11.2, or any other property insurance applicable to the Work, except such rights as they may have to the proceeds of such insurance. The Contractor shall require, by appropriate agreement, written where legally required for validity, similar waivers in favor of the Owner and the Contractor by Subcontractors and Sub-subcontractors. With respect to the waiver of rights of recovery, the term Owner shall be deemed to include, to the extent covered by property insurance applicable thereto, his consultants, employees, and agents and representatives. The Contractor waives as against any Separate Contractor described in Article 6, all rights for damages caused by fire or other perils in the same manner as is provided above as against the Owner. The Owner shall require, by appropriate agreement, written where legally required for validity, similar waivers in favor of the Contractor by any Separate Contractor and his subcontractors and sub-subcontractors.

11.2.4 The Owner as trustee shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within five (5) days after the occurrence of loss to the Owner's exercise of this power, and if such objection is made, the matter shall be decided by a court of competent jurisdiction or as the parties in interest otherwise agree. The Owner as trustee shall, in that case, make settlement with the insurers in accordance with the orders of the court or as otherwise agreed by the parties in interest.

11.2.5 If the Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion thereof, such occupancy or use shall not commence prior to a time

mutually agreed to by the Owner and Contractor and to which the insurance company or companies providing the property insurance have consented by endorsement to the policy or policies. This insurance shall not be canceled or lapsed on account of such partial occupancy or use. Consent of the Contractor and of the insurance company or companies to such occupancy or use shall not be unreasonably withheld.

11.2.6 The Contractor bears the risk of loss or damage to the Work, the Project, materials stored on site or off site, and Owner's improvements and property under Contractor's control, both during construction and prior to Substantial Completion.

11.3 EFFECT OF SUBMISSION OF CERTIFICATES

11.3.1 The Owner shall be under no obligation to review any Certificates of Insurance provided by the Contractor or to check or verify the Contractor's compliance with any and all requirements regarding insurance imposed by the Contract Documents. The Contractor is fully liable for the amounts and types of insurance required herein and is not excused should any policy or certificate of insurance provided by the Contractor not comply with any and all requirements regarding insurance imposed by the Contract Documents.

11.4 FAILURE OF COMPLIANCE

11.4.1 Should the Contractor fail to provide and maintain in force any and all insurance, or insurance coverage required by the Contract Documents or by law, or should a dispute arise between Owner and any insurance company of Contractor over policy coverage or limits of liability as required herein, the Owner shall be entitled to recover from the Contractor all amounts payable, as a matter of law, to Owner or any other parties, had the required insurance or insurance coverage been in force. Said recovery shall include, but is not limited to interest for the loss of use of such amounts of money, plus all attorney's fees, costs and expenses incurred in securing such determination and any other consequential damages arising out of the failure of the Contractor or insurance company to comply with the provisions of the Contract Documents, or any policy required hereby, or any other requirements regarding insurance imposed by law. Nothing herein shall limit any damages for which Contractor is responsible as a matter of law.

11.5 OWNER'S INSURANCE

11.5.1 Property Insurance: The Owner, at his option, may purchase and maintain such insurance as will insure him against loss of use of his property due to fire or other hazards, however caused.

11.5.2 Commercial Public Liability Insurance: The Owner, at his option, may purchase and maintain insurance which will insure and protect him against claims involving bodily injury and property damage to the public. The Owner does not request his insurer to waive any right of subrogation against the Contractor from claims under this coverage.

11.6 LICENSED INSURANCE COMPANIES

11.6.1 All insurance companies providing the above insurance shall be licensed by the Insurance Department of the State of North Carolina and have a minimum AM Best "A-" rating or similar rating from another rating agency reasonably acceptable to Owner.

ARTICLE 12

CHANGES IN THE WORK

12.1 GENERAL PROVISIONS RELATED TO CHANGES

12.1.1 A Construction Change Directive is a document issued pursuant to this Paragraph 12.1.1. The Owner may, at any time, without the agreement of the Contractor, by written order signed by the Owner and Design Consultant designated or indicated to be a Construction Change Directive, make any Changes in the Work or add to or subtract from the Work within the general scope of the Contract. If the Contractor, subsequent to the issuance of a Construction Change Directive, agrees to its terms including any applicable adjustment to the Contract Sum and Contract Time, Contractor shall sign it and it shall become a Change Order.

A Change in the Work is defined as changes within the general scope of the Contract, including, but not limited to changes:

.1 In the Specifications or Drawings;

.2 In the sequence, method or manner of performance of the Work;

.3 In the Owner-furnished facilities, equipment, materials, services or site; or

.4 Directing acceleration in the performance of the Work.

12.1.2 A Change Order is a document executed pursuant to this Paragraph 12.1.2. The Owner and Contractor may agree to Changes in the Work, the Contract Sum, the Contract Time and any other change in the Contract by written agreement signed by Owner, Contractor and Design Consultant designated or indicated to be a Change Order.

12.1.3 The Contractor shall not be entitled to any amount for indirect costs, damages or expenses of any nature, including, but not limited to, so-called "impact" costs, labor inefficiency, wage, material or other escalations beyond the prices upon which the Proposal is based and to which the parties have agreed pursuant to the provisions of Article 12, and which the Contractor, its Subcontractors or Sub-subcontractors or any other person may incur as a result of delays, interferences, suspensions, changes in sequence or the like, for whatever cause, whether reasonable or unreasonable, foreseeable or unforeseeable, or avoidable or unavoidable, arising from the performance of any and all Changes in the Work performed pursuant to this Article 12, unless the delay is caused solely by the Owner or its agent. It is understood and agreed that the Contractor's sole and exclusive remedy in the event the delay is caused solely by the Owner or its agent shall be recovery of his direct costs as compensable hereunder and an extension of the Contract Time, but only in accordance with the provisions of the Contract Documents. The phrase “Owner or its agent” as used in the Contract, does not include the Prime Contractors or their Subcontractors.

12.1.4 No Claim by the Contractor shall be allowed if asserted after final payment under this Contract. No Claim relating to or flowing from a particular change shall be allowed after execution of the Change Order relating to that change or commencement of the change by the Contractor except

as specifically provided in Paragraph 12.2.4.

12.1.5 If any dispute should arise between the parties with respect to an increase or decrease in the Contract Sum or an expansion or contraction in the Contract Time as a result of a Change in the Work, the Contractor shall not suspend performance of a Change in the Work or the Work itself unless otherwise so ordered by the Owner in writing. The Owner shall, however, pay to the Contractor up to the Owner's reasonable estimated value of the Change in the Work, regardless of the dispute, if said Change in the Work will result in an increase in the Contract Sum; and the Owner shall have the right to withhold payment from the Contractor in an amount up to the Owner's reasonable estimated value of the Change in the Work, regardless of the dispute, if said Change in the Work will result in a decrease in the Contract Sum.

12.1.6 No Change in the Work shall be performed without a fully executed Change Order to the Contract, a fully executed Construction Change Directive, or other Modification to the Contract.

12.1.7 If the Contractor intends to assert a Claim under this Article, he must, within ten (10) days after receipt of a Construction Change Directive, Notify the Owner by written statement setting forth the specific nature and cost of such Claim, unless this period is extended by the Owner. The statement of Claim shall include all direct, indirect and impact costs associated with the change, as well as the Contractor's estimate of the schedule impact of the change, if any. The Contractor and its Subcontractors shall not be entitled to reimbursement for any Claims that are not submitted in strict conformance with the Contract. The Contractor shall indemnify and hold the Owner harmless against any Claims by Subcontractors that are waived because they are not submitted in strict conformance with the Contract.

12.2 OWNER DIRECTED CHANGES REQUIRING AN INCREASE IN CONTRACT SUM. (For decreases in Contract Sum, refer to Section 12.6)

12.2.1 If the Change in the Work will result in an increase in the Contract Sum, the Owner shall have the right to require the performance thereof on a lump sum basis, a unit price basis, or a time and material basis, all as hereinafter more particularly described (the right of the Owner as aforesaid shall apply with respect to each such Change in the Work).

If the Owner elects to have the Change in the Work performed on a lump sum basis, its election shall be based on a lump sum Proposal which shall be submitted by the Contractor to the Owner within ten (10) days of the Contractor's receipt of a request therefore (but the Owner's request for a lump sum Proposal shall not be deemed an election by the Owner to have the Change in the Work performed on a lump sum basis). The Contractor's Proposal shall be itemized and segregated by labor and materials for the various components of the Change in the Work (no aggregate labor total will be acceptable) and shall be accompanied by signed Proposals of any Subcontractors who will perform any portion of the Change in the Work and of any persons who will furnish materials or equipment for incorporation therein. The Proposal shall also include the Contractor's estimate of the time required to perform said changes. The Contractor shall provide any documentation that may be requested by the Owner or Design Consultant to support the change proposal, including but not limited to payroll records, insurance rates, material quotes, and rental quotes. The Change Proposal Forms attached as Appendices D-1 and D-2 shall be used to submit change proposals on the Project.

The portion of the Proposal relating to labor, whether by the Contractor's forces or the forces of any of its Subcontractors, may include reasonably anticipated gross wages of job site labor, including foremen, who will be directly involved in the Change in the Work (for such time as they will be so involved), plus payroll costs (including premium costs of overtime time, if

overtime is anticipated, Social Security, Federal or State unemployment insurance taxes and fringe benefits required by collective bargaining agreements entered into by the Contractor or any such Subcontractor in connection with such labor) and up to fifteen percent (15%) of such anticipated gross wages, but not payroll costs, as overhead and profit for the Contractor or any such Subcontractor actually performing the work, as applicable (said overhead and profit to include all supervision except foremen). Payroll costs and labor burden are limited to 39% of the net pay of the worker.

The portion of the Proposal relating to materials may include the reasonably anticipated direct costs to the Contractor or to any of its Subcontractors of materials to be purchased for incorporation in the Change in the Work, plus transportation and applicable sales and use taxes and up to fifteen percent (15%) of said direct material costs as overhead and profit for the Contractor or any such Subcontractor actually performing the work (said overhead and profit to include all small tools), and may further include the Contractor's and any of its Subcontractor's reasonably anticipated rental costs in connection with the Change in the Work (either actual or discounted local published rates), plus up to eight percent (8%) thereof as overhead and profit for the Contractor or any such Subcontractors, as applicable. The Contractor shall provide an itemized breakdown of all transportation and shipping costs, including receipts documenting the expenses. Notwithstanding the above, overhead and profit shall not be applied to any sales tax paid for any purpose or to any transportation or shipping costs incurred by the Contractor or any subcontractor actually performing the work. If any of the items included in the lump sum Proposal are covered by unit prices contained in the Contract Documents, the Owner may, if it requires the Change in the Work to be performed on a lump sum basis, elect to use these unit prices in lieu of the similar items included in the lump sum Proposal, in which event an appropriate deduction will be made in the lump sum amount prior to the application of any allowed overhead and profit percentages. No overhead and profit shall be applied to any unit prices.

The lump sum Proposal may include up to eight percent (8%) of the amount which the Contractor will pay to any of its Subcontractors for Changes in the Work as overhead and profit for the Contractor. The Contractor shall not be reimbursed for the costs of the Subcontractors' Payment and Performance Bonds, as such bonding is not required by the Owner.

12.2.2 In the event that the Contractor fails to submit his Proposal within the designated period, the Owner may order the Contractor to proceed with the Change to the Work and the Contractor shall so proceed. The Owner shall unilaterally determine the reasonable cost and time to perform the Work in question, which determination shall be final and binding upon the Contractor. The Contractor may dispute such action in accordance with the Article 15.

12.2.3 In the event that the parties are unable to agree as to the reasonable cost and time to perform the Change in the Work based upon the Contractor's Proposal and the Owner does not elect to have the Change in the Work performed on a time and material basis, the Owner may choose to make a determination of the reasonable cost and time to perform the Change in the Work, based upon its own estimates, the Contractor's submission or a combination thereof. A Construction Change Directive shall be issued in this case for the amounts of cost and time determined by the Owner and shall become final and binding upon the Contractor, subject to Contractor's right to dispute such action in accordance with Article 15. Owner has the right to direct by Construction Change Directive a Change in the Work, which is the subject of such Change Order. Failure of the parties to reach agreement regarding the cost and time of the performing the Construction Change Directive, shall not relieve the Contractor from performing the Change in the Work promptly and expeditiously.

12.2.3.1 The Owner reserves the right to reject the Contractor's Proposal for a Change in the Work and to elect to perform said Work using a Separate Contractor. Under such circumstances, all provisions of Article 6 shall be in force.

12.2.4 If the Owner elects to have the Change in the Work performed on a time and material basis, the same shall be performed, whether by the Contractor's forces or the forces of any of its Subcontractors or Sub-subcontractors, at actual cost to the entity performing the Change in the Work (without any charge for administration, clerical expense, supervision or superintendence of any nature whatsoever, including foremen, or the cost, use or rental of tools or plant), plus fifteen percent (15%) thereof as the total overhead and profit (except that said fifteen percent (15%) shall not be applied against any payroll costs, as set forth in Paragraph 12.2.1.) The Contractor shall submit to the Owner daily time and material tickets, on a daily basis to include the identification number assigned to the Change in the Work, the location and description of the Change in the Work, the classification of labor employed (including employee names and positions), the materials used, the equipment rented (not tools) and such other evidence of cost as the Owner may require. The Owner may require authentication of all time and material tickets and invoices by persons designated by the Owner for such purpose. The failure of the Contractor to secure any required authentication shall, if the Owner elects to treat it as such, constitute a waiver by the Contractor of any Claim for the cost of that portion of the Change in the Work covered by a non-authenticated ticket or invoice; provided, however, that the authentication of any such ticket or invoice by the Owner shall not constitute an acknowledgment by the Owner that the items thereon were reasonably required for the Change in the Work.

12.2.5 No overhead and profit will be paid by the Owner on account of a Change in the Work except as specifically provided in Section 12.2. Overhead and profit, as allowed under Section 12.2, shall be deemed to include all costs and expenses which the Contractor or any of its Subcontractors may incur in the performance of a Change in the Work and which are not otherwise specifically recoverable by them pursuant to Section 12.2.

12.3 CONTRACTOR NOTICE OF CHANGE

12.3.1 If the Contractor or any of its Subcontractors asserts that any event or occurrence has caused a Change in the Work which change causes an increase or decrease in the Contractor's or its Subcontractors cost or the time required for the performance of any part of the Work under the Contract, including Work not affected directly by the change, the Contractor shall, within ten (10) days of such event, give the Owner written Notice as herein required. Said Notice shall include the instructions or circumstances that are the basis of the Claim and the Contractor's best estimate of the cost and time involved.

12.4 MINOR CHANGES IN THE WORK

12.4.1 The Owner shall have authority to order minor Changes in the Work not involving an adjustment in the Contract Sum or an extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes shall be effected by written order, and shall be binding on the Owner and the Contractor. The Contractor shall carry out such written orders promptly.

12.4.2 The Contractor shall not perform any Changes in the Work unless authorized in writing by the Design Consultant or Owner.

12.5 DIFFERING SITE CONDITIONS

12.5.1 Should the Contractor encounter subsurface and/or latent conditions at the site materially

differing from those shown on the Drawings or indicated in the Specifications or differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Contract, or different from that shown on surveys or tests provided in the bid materials at the time the Owner solicited bids from the construction of the Project, he shall immediately give Notice to the Owner of such conditions before they are disturbed. The Owner and the Design Consultant shall thereupon promptly investigate the conditions and if they find that they materially differ from those shown on the Drawings or indicated in the Specifications, they shall at once make such changes in the Drawings and/or Specifications as they may find necessary. Any increase or decrease of cost resulting from such changes shall be adjusted in the manner provided herein for adjustments as to extra and/or additional work and changes. However, neither the Owner nor the Design Consultant shall be liable or responsible for additional work, costs or Changes to the Work due to material differences between actual conditions and any geotechnical, soils and other reports, surveys and analyses made available for the Contractor's review at the time the Owner solicited bids for the construction of the Project.

12.6 OWNER DIRECTED CHANGES REQUIRING A DECREASE IN CONTRACT SUM.

12.6.1 If the Change in the Work will result in a decrease in the Contract Sum, the Owner may request a quotation by the Contractor of the amount of such decrease. The following provisions shall apply:

The portion of the Proposal relating to labor, whether by the Contractor's forces or the forces of any of its Subcontractors, shall include reasonably anticipated gross wages of job site labor, including foremen, who would have been directly involved in the Work that has been deleted from the Contract, (for such time as they would have been so involved), plus payroll costs (including premium costs of overtime time, if overtime was anticipated, Social Security, Federal or State unemployment insurance taxes and fringe benefits required by collective bargaining agreements entered into by the Contractor or any such Subcontractor in connection with such labor) and seven percent (7%) of such anticipated gross wages, but not payroll costs, as overhead and profit not incurred or earned by the Contractor or any such Subcontractor, as applicable (said overhead and profit to include all supervision except foremen).

The portion of the Proposal relating to materials shall include the reasonably anticipated direct costs which would have been incurred by the Contractor or to any of its Subcontractors of materials which would have been purchased for incorporation in the Work but which has been deleted from the Contract, plus transportation and applicable sales and use taxes which will be avoided and seven percent (7%) of said direct material costs as overhead and profit not incurred or earned by the Contractor or any such Subcontractor (said overhead and profit to include all small tools), and shall further include the Contractor's and any of its Subcontractor's reasonably anticipated rental costs which will be avoided (either actual or discounted local published rates), plus five percent (5%) thereof as overhead and profit not incurred or earned by the Contractor or any such Subcontractors, as applicable. If any of the items included in the lump sum Proposal are covered by unit prices contained in the Contract Documents, the Owner may elect to use these unit prices in determining the amount of reduction to the Contract Sum as a result of a deletion of Work from the Contract. No overhead and profit shall be applied to any unit prices for purposes of calculation such reduction in the Contract Sum.

The lump sum Proposal for Work which would have been performed by any Subcontractors shall include four percent (4%) of that amount as an estimate of the Contractor’s overhead and profit that will not be earned by Contractor due to the decrease in the Contract Sum.

The Contractor's quotation shall be forwarded to the Owner within ten (10) days of the Owner's request and, if acceptable to the Owner, shall be incorporated in the Change Order. If not acceptable, the parties shall make every reasonable effort to agree as to the amount of such decrease, which may be based on a lump sum properly itemized, on unit prices stated in the Contract Documents and/or on such other basis as the parties may mutually determine. If the parties are unable to so agree, the amount of such decrease shall be the total of the estimated reduction in actual cost of the Work, as determined by the Owner in its reasonable judgment, plus overhead and profits stated above. This shall become final and binding upon the Contractor, subject to Contractor's right to dispute such action in accordance with the Article 15.

ARTICLE 13

UNCOVERING AND CORRECTION OF WORK

13.1 UNCOVERING OF WORK

13.1.1 If any portion of the Work is covered contrary to the request of the Owner or the Design Consultant or to requirements specifically expressed in the Contract Documents or to requirements of applicable construction permits, it must, if required in writing by the Owner, be uncovered for his observation and shall be replaced at the Contractor's expense.

13.1.2 If any other portion of the Work has been covered which the Design Consultant or the Owner has not specifically requested to observe prior to being covered, either may request to see such portion of the Work and it shall be uncovered by the Contractor. If such Work be found in accordance with the Contract Documents, the cost of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work be found not in accordance with the Contract Documents, the Contractor shall pay such costs unless it is found that this condition was caused by the Owner, in which event the Owner shall be responsible for the payment of such costs. If such condition was caused by a Separate Contractor, Contractor may proceed against and only against, said Separate Contractor as provided in Article 6. Any costs to the Owner pursuant to this Paragraph shall be determined in accordance with the provisions of Article 12.

13.2 CORRECTION OF WORK

13.2.1 The Contractor shall promptly reconstruct, replace or correct portions of the Work rejected by the Design Consultant or Owner as defective or as failing to conform to the Contract Documents or as not in accordance with the guarantees and warranties specified in the Contract Documents whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected portions of the Work, including compensation for the Design Consultant's and the Owner's additional construction management services made necessary thereby.

13.2.2 The Contractor, unless removal is waived by the Owner, shall remove from the site all portions of the Work which are defective or non-conforming, or if permitted or required, he shall correct such portions of the Work in place at his own expense promptly after receipt of Notice, and such rejected Work shall not thereafter be tendered for acceptance unless the former rejection or requirement for correction is disclosed.

13.2.3 If the Contractor does not proceed with the correction of such defective or non-conforming portions of the Work within a reasonable time fixed by written Notice from the Owner or Design

Consultant, the Owner may either (1) by separate contract or otherwise replace or correct such portions of the Work and charge the Contractor the cost incurred by the Owner thereby and remove and store the materials or equipment at the expense of the Contractor, or (2) terminate this Contract for default as provided in Section 14.3, or both, or take any other measure allowed by law.

13.2.4 The Contractor shall bear the cost of making good all work of the Owner or Separate Contractors destroyed or damaged by such correction or removal.

13.2.5 Nothing contained in this Section 13.2 shall be construed to establish a period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents, including Section 4.6 hereof. The establishment of the time period of one year after the date of Substantial Completion or such longer period of time as may be prescribed by law or by the terms of any warranty required by the Contract Documents relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which his obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to his obligations.

13.3 ACCEPTANCE OF DEFECTIVE OR NON-CONFORMING WORK

13.3.1 If the Owner prefers to accept defective or non-conforming Work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect a reduction in the Contract Sum where appropriate and equitable, or the Owner may elect to accept payment in materials or services, in lieu of a reduction in the Contract Sum. If the amount of a reduction is determined after final payment, it shall be paid to the Owner by the Contractor.

ARTICLE 14

TERMINATION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1 If the Work is stopped for a period of one hundred twenty (120) days by the Owner or under an order of any court or other public authority having jurisdiction, or as a result of an act of government, such as a declaration of a national emergency making materials unavailable, and through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, then the Contractor may, upon seven (7) additional days' written Notice to the Owner and the Design Consultant, terminate the Contract and recover from the Owner payment on a quantum merit basis, for all Work executed for which Contractor has not previously been paid, less any amounts Contractor may owe Owner under the Contract Documents and less any amounts Owner is entitled to withhold from Contractor or backcharge to the Contractor under the Contract Documents or pursuant to law. The Contractor shall not be entitled to collect and hereby expressly waives any overhead or profit on Work not performed and any damages related to that portion of the Contract which has been terminated.

14.2 TERMINATION FOR CONVENIENCE OF THE OWNER

14.2.1 The Owner may, at any time upon ten (10) days written Notice to the Contractor and to the

Contractor's Surety, which Notice shall specify that portion of the Work to be terminated and the date said termination is to take effect, terminate (without prejudice to any right or remedy of the Owner) the whole or any portion of the Work for the convenience of the Owner. The Contractor's sole remedy, in the event of such termination, will be the allowable termination costs permitted by Section 14.4. Contractor shall include termination clauses identical to Article 14 in each of his subcontracts.

14.3 DEFAULT TERMINATION

14.3.1 Ten (10) days after written Notice is mailed to the Contractor and to the Contractor's Surety, the Owner may terminate (without prejudice to any right or remedy of the Owner or any subsequent buyer of any portion of the Work) the employment of the Contractor and his right to proceed either as to the whole or any portion of the Work required by the Contract Documents and may take possession of the Work and complete the Work by contract or otherwise in any one of the following circumstances:

.1 If the Contractor or its Surety refuses or fails to prosecute the Work or any separable part thereof with such diligence as will ensure the Substantial and Final Completion of the Work by the dates specified in the Owner-Contractor Agreement for Substantial and Final Completion or fails to complete the Work or remedy a default within said period;

.2 If the Contractor is in material default in carrying out any provisions of the Contract;

.3 If the Contractor fails to supply a sufficient number of properly skilled workers or proper equipment or materials;

.4 If the Contractor fails to make prompt payment to Subcontractors or for materials or labor, unless he otherwise provides the Owner satisfactory evidence that payment is not legally due;

.5 If the Contractor disregards laws, permits, ordinances, rules, regulations or orders of any public authority having jurisdiction, or fails to follow the instructions of the Owner;

.6 If the Contractor substantially violates any provisions of the Contract Documents; or

.7 If the Contractor refuses or fails to properly schedule, plan, coordinate and execute the Work, as specified herein, so as to perform the Work within the specified Completion Dates, or to provide scheduling or related information, revisions and updates as required by the Contract Documents.

14.3.2 The right of the Contractor to proceed shall not be so terminated under this Section 14.3 if the delays in the completion of the Work are due to unforeseeable causes beyond the control and without the fault or negligence of the Contractor or his Subcontractors as specifically set forth in Section 8.3 hereof.

14.3.3 If, after the Contractor has been terminated for default pursuant to Section 14.3, it is determined that none of the circumstances set forth in Paragraph 14.3.1 exist, then such termination shall be considered a termination for convenience pursuant to Section 14.2. In such case, the Contractor's sole remedy will be the costs permitted by Section 14.4.

14.3.4 If the Owner so terminates the employment of the Contractor due to the Contractor’s default, the Contractor shall not be entitled to receive any further payment until the Work is finished. If

the unpaid balance of the compensation to be paid to the Contractor hereunder shall exceed the expense of so completing the Work (including compensation for additional managerial, administrative, consultant and inspection services, attorney's fees and any damages for delay) such excess shall be paid to the Contractor.

14.3.5 If such expenses referenced in Paragraph 14.3.1, shall exceed the unpaid balance, the Contractor and his sureties shall be liable to the Owner for such excess. If the right of the Contractor to proceed with the Work is partially or fully terminated, the Owner may take possession of and utilize in completing the Work such materials, appliances, supplies, plant and equipment as may be on the site of the terminated portion of the Work and necessary for the completion of the Work. If the Owner does not fully terminate the right of the Contractor to proceed, the Contractor shall continue to perform the part of the Work that is not terminated.

14.3.6 If the Owner terminates the whole or any part of the Work pursuant to Section 14.3, the Owner may procure, upon such terms and in such manner as the Owner may deem appropriate, supplies or services similar to those so terminated, and the Contractor shall be liable to the Owner for any excess costs for such similar supplies or services. The Contractor shall continue the performance of the Contract to the extent not terminated hereunder.

14.4 ALLOWABLE TERMINATION COSTS

14.4.1 If the Owner terminates the whole or any portion of the Work pursuant to Section 14.2, then the Owner shall only be liable to the Contractor for those costs reimbursable to the Contractor in accordance with Paragraph 14.4.2, plus a markup of ten percent (10%) for profit and overhead on the actual fully accounted costs specified under Paragraph 14.4.2; provided however, that if there is evidence that the Contractor would have sustained a loss on the entire Contract had it been completed, no profit or overhead shall be included or allowed hereunder for the Work performed and an appropriate adjustment shall be made reducing the amount of the settlement to reflect the indicated rate of loss. Under no circumstances shall the Contractor be entitled to any loss profit on the Work terminated pursuant to Section 14.2.

14.4.1.1 After receipt of a Notice of Termination, the Contractor shall submit to the Owner his termination Claim, in the form and with certification prescribed by the Owner. Such Claim shall be submitted promptly but in no event later than three (3) months from the effective date of termination, unless one or more extensions in writing are granted by the Owner upon request of the Contractor made in writing within such three (3) month period or authorized extension thereof. However, if the Owner determines that the facts justify such action, he may receive and evaluate any such termination Claim at any time after such three (3) month period or any extension thereof. Upon failure of the Contractor to submit his termination Claim within the time allowed, the Owner may determine, on the basis of information available to him, the amount, if any, due to the Contractor by reason of the termination and such termination shall be final and binding on the Contractor.

14.4.2 If the Owner terminates the whole or any portion of the Work pursuant to Section 14.2, the Owner shall pay the Contractor an amount for supplies, services, or property accepted by the Owner, and which is in accordance with the Contract Documents, in an amount as if the Contract had not been terminated. In addition, in such event, the Owner shall pay to Contractor an amount representing Contractor's actual cost, excluding any overhead and profit for the items and things specified in Subparagraph 14.5.1.6 and not heretofore paid for, appropriately adjusted for any saving of freight or other charges. Under no circumstances shall the Contractor be entitled to any loss profit on the Work terminated pursuant to Section 14.2.

14.4.2.1 The Contractor agrees that neither the Owner nor the Design Consultant will be liable for payments to Contractors or Subcontractors pursuant to Section 14.4.2 unless each contract and subcontract contains termination provisions identical to those set forth in this Article 14. The Owner and the Design Consultant will not be liable to the Contractor or any of the Subcontractors for any costs associated with termination if the contract or subcontract of the party involved does not include the required termination language.

14.4.3 In arriving at any amount due the Contractor pursuant to Section 14.4, there shall be deducted the following:

.1 All unliquidated advance or other payments on account theretofore made to the Contractor applicable to the terminated portion of the Contract;

.2 Any Claim which the Owner may have against the Contractor;

.3 Such amount as the Owner determines to be necessary to protect the Owner against loss because of outstanding or potential liens or claims; and

.4 The agreed price for, or the proceeds of sale of, any materials, supplies or other things acquired by the Contractor sold, pursuant to the provisions of Subparagraph14.5.1.7, and not otherwise recovered by or credited to the Owner, or returned for a refund by the Contractor.

.5 All other amounts the Owner is entitled to withhold form the Contractor or charge to the Contractor pursuant to the Contract or as allowed by applicable law.

14.4.4 The total sum to be paid to the Contractor under Section 14.4 shall not exceed the Contract Sum as reduced by the amount of payments otherwise made or to be made for Work not terminated and as otherwise permitted by the Contract. Except for normal spoilage, and except to the extent that the Owner shall have otherwise expressly assumed the risk of loss, there shall be excluded from the amounts payable to the Contractor, as provided in Paragraph 14.4.2, the fair value, as determined by the Owner, of property which is destroyed, lost, stolen or damaged so as to become undeliverable to the Owner, or to a buyer pursuant to Subparagraph 14.5.1.7.

14.5 GENERAL TERMINATION PROVISIONS

14.5.1 After receipt of a Notice of termination from the Owner, pursuant to Section 14.2 or 14.3, and except as otherwise directed by the Owner, the Contractor shall:

.1 Stop work under the Contract on the date and to the extent specified in the Notice of termination;

.2 Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work under the Contract as is not terminated;

.3 Terminate all orders and subcontracts to the extent that they relate to the performance of the Work terminated by the Notice of termination;

.4 At the option of the Owner, and in lieu of terminating such orders and subcontracts, assign to the Owner in the manner, at the times and to the extent directed by the Owner in writing, all of the rights in the such orders and subcontracts,

.5 Settle all outstanding liabilities and all Claims arising out of such termination or orders and subcontracts, with the approval or ratification of the Owner in writing, to the extent he may require, which approval or ratification shall be final for all the purposes of this Article;

.6 Transfer title and deliver to the entity or entities designated by the Owner, in the manner, at the times and to the extent directed by the Owner to the extent specifically produced or specifically acquired by the Contractor for the performance of such portion of the Work as had been terminated, the following:

(1) The fabricated or unfabricated parts, Work in process, partially completed supplies and equipment, materials, parts, tools, dies, jigs and other fixtures, completed Work, supplies and other material produced as part of, or acquired in connection with the performance of, the Work terminated by the Notice of termination; and

(2) The completed or partially completed plans, drawings, information, releases, manuals and other property related to the Work and which, if the Contract had been completed, would have been required to be furnished to the Owner;

.7 Use his best efforts to return for a refund or sell, in the manner, at the times, to the extent and at the price or prices directed or authorized by the Owner, any property of the types referred to in Subparagraph 14.5.1.6; provided, however, that the Contractor:

(1) Shall not be required to extend credit to any buyer, and

(2) May acquire any such property under the conditions prescribed by and at a price or prices approved by the Owner in writing; and provided further that the proceeds of any such transfer or disposition shall be applied in reduction of any payments to be made by the Owner to the Contractor under the Contract or shall otherwise be credited to the Contract Sum covered by the Contract or paid in such other manner as the Owner may direct;

.8 Complete performance of such part of the Work as shall not have been terminated by the Notice of termination;

.9 Take such action as may be necessary, or as the Owner may direct, for the protection and preservation of the property related to the Contract which is in the possession of the Contractor and in which the Owner has or may acquire an interest; and

.10 Otherwise mitigate any damages Contractor claims to suffer as a result of a termination.

14.5.2 The Contractor shall, from the effective date of termination until the expiration of three (3) years after final settlement under the Contract, preserve and make available to the Owner, at all reasonable times at the office of the Contractor, but without direct charge to the Owner, all his books, records, documents and other evidence bearing on the costs and expenses of the Contractor under the Contract and relating to the Work terminated hereunder, or, to the extent approved by the Owner, photographs, micro-photographs or other authentic reproductions thereof.

14.5.3 If the termination, pursuant to Section 14.2, be partial, the Contractor may file with the Owner a Claim for an equitable adjustment of the price or prices specified in the Contract relating to the continued portion of the Contract (the portion not terminated by the Notice of termination),

and such equitable adjustment as may be agreed upon shall be made in such price or prices. Any Claim by the Contractor for an equitable adjustment under this Paragraph must be asserted within thirty (30) days from the effective date of the Notice of termination.

14.5.4 The Contractor shall refund to the Owner any amounts paid by the Owner to the Contractor in excess of costs reimbursable under Section 14.4.

14.5.5 The Contractor shall be entitled to only those damages and that relief from termination by the Owner as specifically provided in Article 14.

ARTICLE 15

DISPUTE RESOLUTION

15.1 INITIATING CLAIMS

15.1.1 Claims must be initiated by written Notice to the Owner and to the party against whom the Claim is made with a copy to the Design Consultant. The responsibility to substantiate Claims shall rest with the party making the Claim.

15.1.2 Nothing in the Contract shall be construed as meaning that the Owner's assessment of Liquidated Damages is a Claim as defined herein, or that the Owner has the burden of proof to assess Liquidated Damages. Should the Owner assess Liquidated Damages, the burden of proving that such damages should not have been assessed shall rest upon the Contractor.

15.2 RESOLUTION OF CLAIMS AND DISPUTES BETWEEN CONTRACTOR AND OWNER

15.2.1 Claims by Contractor against Owner and by Owner against Contractor, including those alleging an error or omission by the Design Consultant shall be subject to the process set forth in this Section 15.2. Such Claims shall be referred initially to the Design Consultant for a decision. A final decision by the Design Consultant, or the failure of the Design Consultant to issue a final decision shall be required as a condition precedent to mediation or litigation of all such Claims arising prior to the date final payment is due. The Design Consultant will initially decide disputes between Owner and Contractor.

15.2.2 The Design Consultant will review Claims by Contractor and Owner against each other and within twenty (20) days of the receipt of the written Claim and take one or more of the following actions:

.1 Request additional supporting data from the claimant or a response with supporting data from the other party;

.2 Reject the Claim in whole or in part;

.3 Approve the Claim;

.4 Suggest a compromise; or

.5 Advise the parties that the Design Consultant is unable to resolve the Claim if the Design Consultant lacks sufficient information to evaluate the merits of the Claim or if the Design Consultant concludes that it would be inappropriate for the Design Consultant to resolve the Claim.

15.2.3 In evaluating Claims made under this Section 15.2, the Design Consultant may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who assist the Design Consultant in rendering a decision.

15.2.4 If the Design Consultant requests a party to provide a response to a Claim under this Section 15.2, or to furnish additional supporting data, such party shall respond, within ten (10) days after receipt of such request, and shall within such time period, either provide a response to the requested supporting data, advise the Design Consultant when the response or supporting data will be furnished, or advise the Design Consultant that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Design Consultant will either reject or approve the Claim in whole or in part.

15.2.5 The Design Consultant will approve or reject Claims under this Section 15.2 by written decision, which shall state the reason thereof and which shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Design Consultant under this Section 15.2 shall be final and binding on the parties but subject to mediation and litigation.

15.2.6 When a written decision of the Design Consultant under this Section 15.2 states that the decision is final but subject to mediation, then a demand for mediation of a Claim covered by such decision must be made within thirty (30) days after the date on which the party making the demand receives the final written decision. Any failure to demand mediation within said thirty (30) days' period shall result in the Design Consultant's decision becoming final and binding to all parties. Claims not resolved in mediation shall be subject to litigation if in accordance with the applicable statutes of limitation and repose.

15.2.7 Upon receipt of a Claim under Section 15.2 against the Contractor or at any time thereafter, the Design Consultant or the Owner may, but is not obligated to, notify the Surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Design Consultant or the Owner may, but are not obligated to, notify the Surety and request the Surety's assistance in resolving the controversy.

15.2.8 If the Design Consultant deems that a Claim under this Section 15.2 is valid, the Design Consultant shall require all parties to the dispute to share the cost of the Design Consultant's review equitably. If the Design Consultant deems that a Claim under this Section 15.2 is invalid, the Design Consultant shall require the complaining party to bear the cost of the Design Consultant's review. In any event, the Design Consultant may require the complaining party to submit a deposit equivalent to the Design Consultant's hourly rate multiplied by the amount of time the Design Consultant estimates, in the Design Consultant sole discretion, that will be necessary to review the Claim. The Design Consultant shall return any unused portion of this initial deposit to the complaining party following the Design Consultant's completion of the Design Consultant's review of the Claim. Nothing in these procedures shall entitle the Design Consultant to compensation for additional services from the Owner that is not authorized pursuant to the terms and conditions of the Agreement for Design Consultant Services.

15.3 TIME LIMITS ON CLAIMS

15.3.1 Unless a shorter time is provided in the Contract Documents, Claims by Contractor or any party except Owner must be initiated within twenty (20) days after occurrence of the event giving rise to such Claim or within twenty (20) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later. Claims against the Owner shall be initiated in strict

conformance with the Contract Documents. Nothing in these procedures shall extend the period within or the manner in which Claims against the Owner must be submitted. Claims must be initiated by written Notice to the Owner and written notice to the other party and to the Design Consultant. Any Claim against the Owner that is not initiated within the applicable time period is waived. Claims by Owner may be made at any time within the applicable statute of limitations and repose.

15.4 CONTINUING CONTRACT PERFORMANCE

15.4.1 Pending final resolution of a Claim, the Contractor shall proceed diligently with the performance of the Contract, unless instructed otherwise in writing by the Owner.

15.5 MEDIATION

15.5.1 As required by N.C.G.S 143-128 (f1), any Claim as defined herein, which exceeds fifteen thousand dollars($15,000.00), and which concerns a party involved in the Project, including the Owner, Contractor, Design Consultant, any construction manager, Separate Contractors, or first and lower tier Subcontractors and which arise out of the Contract or the construction process, except those waived Claims shall, be subject to mediation as a condition precedent to the institution of legal proceedings by any party, except that any party may institute legal proceedings or perfect any mechanic's or materialmen's lien in order to meet any applicable statute of limitations or similar deadline prior to engaging in mediation.

15.5.2 The parties shall endeavor to resolve their Claims under this Section 15.5 by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the rules established by the Owner.

15.5.3 The parties shall share cost of the mediation equally except that if the Owner is a party to the dispute, the Owner shall pay at least one third of the cost of the mediation.

15.5.4 The mediation shall be held in a place where the Project is located, unless another location is mutually agreed upon.

15.5.5 Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

END OF GENERAL CONDITIONS

Appendix A

CONTRACTOR'S SALES TAX REPORT
N.C. STATE & LOCAL SALES TAXES PAID

OWNER: _____ **PROJECT:** _____

CONTRACTOR: _____ **FOR PERIOD:** _____

ADDRESS: _____ **TO:** _____

VENDOR NAME	ADDRESS	MATERIAL PURCHASED	INVOICE NUMBER	INVOICE DATE	INVOICE AMOUNT	N.C. TAX	COUNTY TAX	NAME OF COUNTY
				Totals				

I hereby certify that, during the period stated above, North Carolina sales and use taxes were paid as listed above, with respect to building materials, supplies, fixtures, and equipment which have become a part of, or annexed to, a building or structure erected, altered or repaired for the New Hanover County Schools, and the vendors from whom the property was purchased, the dates, numbers and amounts of the invoices covering the purchases, and the North Carolina sales and use taxes paid thereon. Also include the cost of property withdrawn from warehouse stock and North Carolina sales or use taxes paid thereon.

By:_____ **Title:** _____

Sworn to and Subscribed before me, this _____ day of _____, 20___.

_____, Notary. My Commission Expires: _____

Form revised 8/1/18

Appendix B

Sexual Offender Registry and Criminal Background Check Certification Form

Check the appropriate box to indicate the type of check:
□ Initial
□ Supplemental
□ Annual

I, _____ (insert name), _____ (insert title) of _____ (insert company name) hereby certify that I have performed all of the required sexual offender registry and criminal background checks required under this Agreement for all contractual personnel (employees, agents, ownership personnel, or contractors) who may be used to deliver goods or provide services under this Agreement, including the North Carolina Sex Offender and Public Protection Registration Program, the North Carolina Sexually Violent Predator Registration Program, and the National Sex Offender Registry. I further certify that none of the individuals listed below appears on any of the above-named registries or has any criminal conviction listed in the Agreement, and that I will not assign any individual to deliver goods or perform services under this Agreement if said individual appears on any of the sex offender registries or has any criminal conviction listed in the Agreement, without the prior written permission of Owner. I agree to maintain all records and documents associated with these registry and criminal background checks, and that I will provide such records and documents to the Owner upon request. I specifically acknowledge that the Owner retains the right to audit these records to ensure compliance with this section at any time in the Owner's sole discretion. I acknowledge that I am required to perform these checks and provide this certification form before any work is performed under the Agreement (initial check), any time additional contractual personnel may perform work under the Agreement (supplemental check), and at each anniversary date of the Agreement (annual check).

Contractual Personnel Names	**Job Title**
1. _____	_____
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____

(attach additional page(s) if needed)

I attest that the forgoing information is true and accurate to the best of my knowledge.

_____ (print name) _____ (signature)
_____ (title) _____ (date)

Appendix C

NEW HANOVER COUNTY SCHOOLS
ALLOWANCE EXPENDITURE AUTHORIZATION (AEA)

OWNER
ARCHITECT
CONTRACTOR

PO #:

PROJECT:
(Name & Address)

AEA NO.: _____

DATE: _____

NHCS PROJECT NO: _____

CONTRACTOR:
(Name & Address)

CONTRACT DATED: _____

CONTRACT FOR: _____

Original Contract Allowance Amount(s):

_____
_____

Current Contract Allowance Amount(s):

_____
_____

(Attach Work Change Proposal Request(s) and associated documentation)
CPR 1- xxxxx
CPR 2- xxxxx

A. Description of Contract Allowance utilized for this Authorization:	**Unforeseen Work**
B. Original Contract Allowance amount:	$ -
C. Contract Allowance Expenditures previously authorized:	$ -
D. Contract Allowance will be [increased][decreased] by this Authorization:	$ -
E. Contract Allowance balance including this Authorization	$ -

Approval Recommended:	Owner Approval:	Contractor Acceptance:
ARCHITECT:	**OWNER:** New Hanover County Schools	**CONTRACTOR:**
ADDRESS:	**ADDRESS:** 6410 Carolina Beach Road Wilmington, NC 28412	**ADDRESS:**
BY: (Signature)	**BY:** Leanne N. Lawrence (Signature)	**BY:** (Signature)
DATE:	**DATE:**	**DATE:**

Note: The Allowance Expenditure Authorization is not a Change Order and does not modify Contract Sum or contract time. Upon signature by all parties, this document becomes immediately effective.

APPENDIX D-1
CHANGE PROPOSAL FORM
Time and Material / Unit Price Estimate

Project: _____ **Proposal #:** _____
Contract: _____ **Project #:** _____
Contractor: _____ **Contractor #:** _____

Description of change:

Materials & Labor	**SUBTOTALS**
Estimated cost of labor & materials including shipping, overtime, payroll taxes and insurance, and overhead and profit. Maintain accurate records for billing purposes.	**$0.00**
Unit Price Work Estimated quantity of units required less allowance units not used, times the established unit cost. Maintain accurate records for billing purposes. Third party records may be required.	**$0.00**
Equipment Rental Estimated cost of equipment rental including shipping, taxes and overhead and profit. Maintain accurate records for billing purposes.	**$0.00**
Subcontractors Estimated cost of subcontracts including all subcontractor expenses. Maintain accurate records for billing purposes.	**$0.00**

	Subtotal of Proposal	**$0.00**
Bonds (% of subtotal of proposal)	**2.0%**	**$0.00**
	*** TOTAL NOT TO EXCEED CHANGE PROPOSAL ESTIMATE**	**$0.00**

Time Extension Requests: ____day(s) Schedule Activity # Affected: _____

The Contractor agrees to perform the work outlined in this change proposal for an amount that shall not exceed the amount stated above and in accordance with the Contract documents if the work is authorized by the Owner. If the price to perform the work is expected to exceed the above stated amount, a new change proposal form for the additional work is required.

* Actual amount paid will be based on actual documented expenses.

Contractor's Signature: _____ **Date:** _____

Approval Recommended by Design Consultant: _____ **Date:** _____

Owner's Representative Approval: _____ **Date:** _____

APPENDIX D-2
CHANGE PROPOSAL FORM
Lump Sum Change Proposal Form

Project: _____ **Proposal #:** _____
Contract: _____ **Project #:** _____
Contractor: _____ **Contractor #:** _____

Description of change:

					SUBTOTALS
Materials	(Attach list with Qty, Item, Unit $, Unit mh, Total mh, OT mh, Total $)				
1	Total Direct Cost of Materials			**$0.00**	
2	Overhead & Profit on Item 1. (15% maximum, includes small tools & consumables)			**$0.00**	
3	Sales Tax (on item 1 only)			**$0.00**	
4	Shipping & Transportation			**$0.00**	**$0.00**
Labor					
5	Total Manhours:	**0** MH @	**$0.00** /hr.	**$0.00**	
6	Overhead & Profit on Item 5. (15% maximum on straight labor cost, not premium portion) (O & P includes supervisor's time)			**$0.00**	
7	Payroll Taxes & Insurance (on item 5 only)	**39.0%**		**$0.00**	**$0.00**
Equipment Rental	(Include quotes)				
8	Equipment Rental			**$0.00**	
9	Overhead & Profit on Item 8. (8% maximum)			**$0.00**	**$0.00**
Subcontractors	(Include quotes with material & equipment backup)				
10	Subcontractors			**$0.00**	
11	Overhead & Profit on Item 10. (8% maximum)			**$0.00**	**$0.00**
				Subtotal of Proposal	**$0.00**
12	Bonds (% of subtotal of proposal)		**2.0%**		**$0.00**
				TOTAL OF CHANGE PROPOSAL	**$0.00**

Time Extension Requests: ____ day(s) Schedule Activity # Affected: _____

The Contractor agrees to perform the work outlined in this change proposal for the amount specified above and in accordance with the Contract documents if the work is authorized by the Owner.

Contractor's Signature: _____ _____ **Date:** _____

Approval Recommended by Design Consultant: _____ _____ **Date:** _____

Owner's Representative Approval: _____ _____ **Date:** _____

SECTION VI

MISCELLANEOUS FORMS

- Affidavit E – MBE Documentation for Contract Payments
- E-Verify Form
- SEA-Tech 2023-2024 Calendar
- Close-Out Document Checklist

AFFIDAVIT E

MBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

SCO Project ID: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority Business Enterprises on this project for the above-mentioned period.

MBE FIRM NAME	* TYPE OF MBE	AMOUNT PAID THIS MONTH (With This Pay App)	TOTAL PAYMENTS TO DATE	TOTAL AMOUNT COMMITTED

*Minority categories: Black (B), Hispanic (H), Asian American (AA), American Indian (AI), White Female (WF), Socially and Economically Disadvantaged (SED)

Approved/Certified By:

_____ _____
Name Title

_____ _____
Date Signature

SUBMIT WITH EACH PAY REQUEST - FINAL PAYMENT - FINAL REPORT

E-VERIFY AFFIDAVIT

STATE OF _____
COUNTY OF _____
I, _____ (the individual attesting below), being duly authorized by

and on behalf of _____ (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 will comply with E-Verify, and Employer will ensure compliance with E-Verify by any and all 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: _____

Seal

_____
Notary Public

CLOSE-OUT DOCUMENT CHECKLIST

Project: SEA-Tech HS SCI Grant Add & Renov. Project Number: 22-90458

Contractor: _____ Substantial Completion Date: _____

Note: When all of the following close-out documents have been completed and received, this checklist should be completed Copies of the documents or the originals, as indicated by the asterisks, should be attached and the checklist should accompany the final application for payment. The checklist with attachmentsd will be filed in the project's "F" file following approval of the final application for payment.

√ COMPLETE	RESPONSIBILITY	DOCUMENTATION	**Responsibility: S = School System, A = Architect, C = Contractor** **Documentation: * = Original Document to be attached ** Copy of the Cover Document attached**
	S	**	Fully executed Contract
	S	**	Fully executed Certificate of Substantial Completion with attached punchlist
	A/S	**	Fully Executed Final Change Order (i.e. includes allowance, liquidated damages, deductions for work done by others, etc.
	A/S	*	Final AEA with allowance balances zeroed out (may be attached with final change order)
	A/C	**	Final approved Application for Payment
	C	*	Consent of Surety to Final Payment
	C	*	Contractor's Affidavit of Release of Liens (properly signed and notarized)
	C	*	Contractor's Affidavit of Payment of Debts and Claims (properly signed and notarized)
	C	*	Properly executed Release of Liens by Subcontractor's and/or vendors (if applicable for those who have had problems with payments, etc.)
	C	*	Certificate of Occupancy from proper municipality
	C	*	Contractor's One-Year Warranty (notarized)
	C	**	Warranty summary sheet and original warranties for specific items (originals are included in Operation and Maintenance Manuals)
	C	*	Certification letter from Contractor stating that no asbestos containing materials were used on the project
	A	*	Certification letter from Architect or Engineer stating that no asbestos containing materials were specified on the project (per EPA regulations)
	S	**	Transmittal indicating copy of asbestos certification letters have been forwarded to New Hanover County Schools Facility Planning & Construction Dept. Asbestos File.
	A	*	Architect's and MEP Engineer's certification letter stating that the all punchlist items are complete, the work is per contract requirements, and recommending final payment be made to the Contractor
	A	*	Architect's or Engineer's letter regarding liquidated damages (if none, so state)
	S	*	Transmital indicating keys have been given to NHCS (should be signed by person receiving keys)
	C	**	Final lists of MBE firms used on the project with final contract amounts & percentage of the total prime contract for each
	C	**	Final lists of Subcontractors with names, addresses, and phone numbers including emergency numbers (originals are included in the Operations and Maintenance Manuals)
	C	**	Transmittal from Contractor indicating electronic copies of all approved submittals have been forwarded to New Hanover County Schools Facility Planning & Construction Dept.
	A/C	*	Record drawings received and cover letter from A/E stating they have been received and are complete and accurate as possible
	A/C	*	Operations and Maintenance Manuals received and a cover letter from A/E stating that they have been reviewed and are complete
	S	**	Transmittal indicating Record Drawings, Operations and Maintenance Manuals have been been distributed to Maintenance and School.
	A/C	*	Certified testing and balance report for HVAC system has been received and a cover letter from engineer stating that it has been reviewed and approved

FINAL PAYMENT FOR BOTH THE ARCHITECT/ ENGINEER AND CONTRACTOR TO BE WITHHELD UNTIL ALL DOCUMENTS FROM BOTH PARTIES ARE RECEIVED

_____ _____
Project Manager's Signature Date

File # : _____

ECS Southeast, LLP

Geotechnical Engineering Report

Southeast Area Technical HS Construction Trades Addition

5301 Sidbury Road
Castle Hayne, New Hanover County, North Carolina

ECS Project No. 22:32654

January 6, 2023

January 6, 2023

Ms. Kim Gordon
New Hanover County Schools
6410 Carolina Beach Road
Wilmington, North Carolina 28412

ECS Project No. 22:32654

Reference: Geotechnical Engineering Report
Southeast Area Technical HS Construction Trades Addition
5301 Sidbury Road
Castle Hayne, New Hanover County, North Carolina

Dear Ms. Gordon:

ECS Southeast, LLP (ECS) has completed the subsurface exploration and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project along with the results of the field exploration conducted and our design and construction recommendations.

It has been our pleasure to be of service during the design phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southeast, LLP

Freddie Wescott
Senior Project Manager
FWescott@ecslimited.com

Winslow Goins, PE
Principal Engineer
WGoins@ecslimited.com

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APPENDICES

Appendix A – Drawings & Reports
- Site Location Diagram
- Exploration Location Diagram

Appendix B – Field Operations
- Reference Notes for CPT Testing
- Cone Penetration Test Sounding Logs (S-1 through S-3)

Appendix C – Supplemental Report Documents
- GBA Document

EXECUTIVE SUMMARY

The following summarizes the main findings of the exploration, particularly those that may have a cost impact on the planned development. Further, our principal foundation recommendations are summarized. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- The geotechnical exploration performed for the site included three (3) electronic cone penetration test (CPT) soundings drilled to refusal or termination depths ranging from approximately 40 to 50 feet.

- Provided the subgrades are prepared as recommended in this report and the column and wall loads do not exceed 50 kips and 1.5 kips per liner foot, respectively, the planned buildings may be supported by conventional shallow foundations consisting of column or strip footings bearing on compacted structural fill and natural soils using a net allowable soil bearing pressure of 2,000 psf.

- Groundwater was encountered in the soundings at depths ranging from approximately 3.0 feet to 7.0 feet below existing grade.

Please note this Executive Summary is an important part of this report and should be considered a ***"summary"*** only. The subsequent sections of this report constitute our findings, conclusions, and recommendations in their entirety.

1.0 INTRODUCTION

The purpose of this study was to provide geotechnical information for the design of foundations for the proposed new construction trades addition located at 5301 Sidbury Road in Castle Hayne, NC. The recommendations developed for this report are based on project information supplied by Ms. Kim Gordon of New Hanover County Schools.

Our services were provided in accordance with our Proposal No. 22:26905, dated November 28, 2022, as authorized by Purchase Order No. 20233039 date December 19, 2022.

This report contains the procedures and results of our subsurface exploration programs, review of existing site conditions, engineering analyses, and recommendations for the design and construction of the project.

The report includes the following items.

- A brief review and description of our field test procedures and the results of testing conducted;
- A review of surface topographical features and site conditions;
- A review of subsurface soil stratigraphy with pertinent available physical properties;
- Preliminary foundation recommendations;
  - Allowable bearing pressure;
  - Settlement estimates (total and differential);
- Site development recommendations;
- Suitability of soils for use as fill material;
- Seismic site class and liquefaction recommendations;
- Discussion of groundwater impact;
- Compaction recommendations;
- Site vicinity map;
- Exploration location plan; and
- CPT sounding logs.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION/CURRENT SITE USE/PAST SITE USE

The proposed site is located at 5301 Sidbury Road in Castle Hayne, New Hanover County, North Carolina. The site is bounded on the south by a parking lot, on the west and north by the school driveway, and on the east by sidewalks. Figure 2.1.1 below shows an image of where the site is located.

Figure 2.1.1 Site Location

The site currently consists of an open grassy area. Based on our site visit and approximate elevations from Google Earth, the site is relatively level with typical elevations on site ranging from approximate 28 to 29 feet.

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the planned development including proposed building and related infrastructure.

SUBJECT	DESIGN INFORMATION / ASSUMPTIONS
Usage	Institutional
Column Loads	Up to 50 kips
Wall Loads	Up to 1.5 klf

ECS understands the project consists of the construction of a new Pre-Engineered shop building.

3.0 FIELD EXPLORATION

Our exploration procedures are explained in greater detail in Appendix B including the Reference Notes for Cone Penetration Soundings. Our scope of work included performing three (3) CPT soundings. Our approximate CPT sounding locations are shown on the Exploration Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil. Please refer to the CPT sounding logs in Appendix B.

The site is located in the Coastal Plain Physiographic Province of North Carolina. The Coastal Plain is composed of seven terraces, each representing a former level of the Atlantic Ocean. Soils in this area generally consist of sedimentary materials transported from other areas by the ocean or rivers. These deposits vary in thickness from a thin veneer along the western edge of the region to more than 10,000 feet near the coast. The sedimentary deposits of the Coastal Plain rest upon consolidated rocks similar to those underlying the Piedmont and Mountain Physiographic Provinces. In general, shallow unconfined groundwater movement within the overlying soils is largely controlled by topographic gradients. Recharge occurs primarily by infiltration along higher elevations and typically discharges into streams or other surface water bodies. The elevation of the shallow water table is transient and can vary greatly with seasonal fluctuations in precipitation.

Table 3.1.1 Subsurface Stratigraphy

Approximate Depth Range	Stratum	Description	Ranges of N*-Values(1) blows per foot (bpf)
0 to 0.33 (Surface cover)	N/A	Topsoil was encountered on-site with an observed thickness of approximately 3 inches. Deeper topsoil or organic laden soils are most likely present in wet, poorly drained areas and potentially unexplored areas of the site.	N/A
0.33 to 10	I	Very Loose to Medium Dense, Silty, Gravely, and Clean SAND (SM, SC, SP), Soft to Stiff, Sandy SILT (ML).	2 to 41
10 to 30	II	Soft to Stiff, Clayey and Sandy SILT (ML), Silty and Lean CLAY (CL), and Very Loose to Medium Dense, Silty and Clean SAND (SM, SP).	2 to 15
30 to 50	II	Loose to Very Dense, Silty, Gravely, and Clean SAND (SM, SP), Soft to Very Hard, Clayey and Sandy SILT (ML), and Silty and Lean CLAY (CL).	4 to 91

Notes: (1) Equivalent Corrected Standard Penetration Test Resistances

3.2 GROUNDWATER OBSERVATIONS

Water levels were measured in our CPT soundings and are shown in Appendix B. Groundwater depths measured at the time of drilling ranged from 3.0 to 7.0 feet below the ground surface. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

4.0 DESIGN RECOMMENDATIONS

4.1 FOUNDATIONS

Provided subgrades and structural fills are prepared as recommended in this report and in-place densification is performed by the design/build contractor, the proposed structures can be supported by shallow foundations including column footings and continuous wall footings. We recommend the foundation design use the following parameters*:*

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure(1)	2,000 psf	2,000 psf
Acceptable Bearing Soil Material	Stratum I or Approved structural fill	Stratum I or Approved structural Fill
Minimum Width	24 inches	12 inches
Minimum Footing Embedment Depth (below slab or finished grade) (2)	12 inches	12 inches
Minimum Exterior Frost Depth (below final exterior grade)	6 inches	6 inches
Estimated Total Settlement (3)	Less than 1- inch	Less than 1- inch
Estimated Differential Settlement (4)	Less than ¾ inches between columns	Less than ¾ inches

Notes:

(1) Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.
(2) For bearing considerations and frost penetration requirements.
(3) Based on assumed structural loads. If final loads are different, ECS must be contacted to update foundation recommendations and settlement calculations.
(4) Based on maximum column/wall loads and variability in borings. Differential settlement can be re-evaluated once the foundation plans are more complete.

Potential Undercuts: Most of the soils at the foundation bearing elevation are anticipated to be suitable for support of the proposed structure. If soft or unsuitable soils are observed at the footing bearing elevations, the unsuitable soils should be undercut and removed. Any undercut should be backfilled with approved structural fill up to the original design bottom of footing elevation; the original footing shall be constructed on top of the approved structural fill.

4.2 SLABS ON GRADE

The on-site natural soils are generally considered suitable for support of the lowest floor slabs. Based on the assumption that the finished floor elevation is around the current site elevations, it appears that the slabs for the structure will likely bear on the near surface Stratum I soils SAND (SM, SP) or approved structural fill. The following graphic depicts our soil-supported slab recommendations:

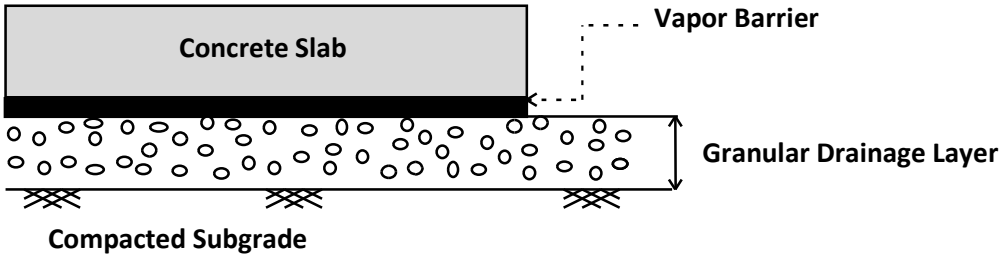


Figure 4.2.1

1. Drainage Layer Thickness: 6 inches
2. Drainage Layer Material: GRAVEL (GP, GW) or SAND containing <5% passing the #200 sieve (SP, SW)
3. Subgrade compacted to 98% maximum dry density per ASTM D698

Subgrade Modulus: Provided the structural fill and granular drainage layer are constructed in accordance with our recommendations, the slab may be designed assuming a modulus of subgrade reaction, k_1 of 150 pci (lbs./cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

Vapor Barrier: Before the placement of concrete, a vapor barrier may be placed on top of the granular drainage layer to provide additional protection against moisture penetration through the floor slab. Surface curing of the slab should be performed in accordance with ACI recommendations to reduce the potential for uneven drying, curling and/or cracking of the slab. Depending on proposed flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

Slab Isolation: Ground-supported slabs should be isolated from the foundations and foundation-supported elements of the structures so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration (turn down slabs or post tension mats) prevents the use of a free-floating slab, the slab should be designed to avoid overstressing of the slab. Maximum differential settlement of soils supporting interior slabs is anticipated to be less than 0.5 inches in 50 feet.

4.3 SEISMIC DESIGN CONSIDERATIONS

Seismic Site Classification: The ASCE7-16 standard requires site classification for seismic design based on the upper 100 feet of a soil profile. At least two methods are utilized in classifying sites, namely the shear wave velocity (v_s) method and the Standard Penetration Resistance (N-value) method. The first method (shear wave velocity) was used in classifying this site.

Based upon our interpretation of the subsurface conditions, the appropriate Seismic Site Classification is "D."

Liquefaction: When a saturated soil with little to approximately no cohesion liquefies during a major earthquake, it experiences a temporary loss of shear strength as a result of a transient rise in excess pore water pressure generated by strong ground motion. Flow failure, lateral spreading, differential settlement, loss of bearing, ground fissures, and sand boils are evidence of excess pore pressure generation and liquefaction.

The potential for liquefaction at the site is considered low based upon the CPT results and the liquefaction index procedure developed by Iwasaki (1982). Based on our CPT results and our evaluation using a site peak ground acceleration of 0.119 (PGA_m) per ASCE7-16, an earthquake event with a magnitude of 7.3 and procedures developed by Robertson (2009), Moss et al. (2006), and Boulanger & Idriss (2014), the liquefaction induced settlement at the subject site is estimated to be approximately 2.6 inches or less. The max differential settlement is estimated to be 0.6 inches over a distance of 65 feet.

Ground Motion Parameters: In addition to the seismic site classification, ECS has determined the design spectral response acceleration parameters following the ASCE7-16 methodology. The Mapped Reponses were estimated from the ATC Hazards by Location Tool available from the USGS website (https://hazards.atcouncil.org). The design responses for the short (0.2 sec, S_{DS}) and 1-second period (S_{D1}) are noted in bold at the far-right end of the following table.

GROUND MOTION PARAMETERS – SITE CLASS D [ASCE7-16 Method]								
Period (sec)	**Mapped Spectral Response Accelerations (g)**		**Values of Site Coefficient for Site Class**		**Maximum Spectral Response Acceleration Adjusted for Site Class (g)**		**Design Spectral Response Acceleration (g)**	
Reference	Figures 1613.3.1 (1) & (2)		Tables 1613.3.3 (1) & (2)		Eqs. 16-37 & 16-38		Eqs. 16-39 & 16-40	
0.2	S_S	0.148	F_a	1.6	$S_{MS}=F_aS_s$	0.237	$S_{DS}=2/3\ S_{MS}$	**0.158**
1.0	S_1	0.066	F_v	2.4	$S_{M1}=F_vS_1$	0.158	$S_{D1}=2/3\ S_{M1}$	**0.105**

The Site Class definition should not be confused with the Seismic Design Category designation which the Structural Engineer typically assesses.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping vegetation, rootmat, topsoil, existing fill, and any soft or unsuitable materials from the 10-foot expanded building and 5-foot expanded pavement limits. Borings and soundings performed in "undisturbed" areas of the site contained an observed approximately 3 inches of topsoil. Deeper topsoil or organic laden soils may be present in wet, low-lying, and poorly drained areas. ECS should be retained to verify that topsoil and unsuitable surficial materials have been removed prior to the placement of structural fill or construction of structures.

5.1.2 Proofrolling

Prior to fill placement or other construction on subgrades, the subgrades should be evaluated by an ECS field technician. The exposed subgrade should be thoroughly proofrolled with construction equipment having a minimum axle load of 10 tons [e.g., fully loaded tandem-axle dump truck]. Proofrolling should be traversed in two perpendicular directions with overlapping passes of the vehicle under the observation of an ECS technician. This procedure is intended to assist in identifying any localized yielding materials.

Where proofrolling identifies areas that are unstable or "pumping" subgrade those areas should be repaired prior to the placement of any subsequent Structural Fill or other construction materials. Methods of stabilization include undercutting and moisture conditioning. The situation should be discussed with ECS to determine the appropriate procedure. Test pits may be excavated to explore the shallow subsurface materials to help in determining the cause of the observed unstable materials, and to assist in the evaluation of appropriate remedial actions to stabilize the subgrade.

5.1.3 Site Temporary Dewatering

Temporary Dewatering: Temporary dewatering operations can be managed by the use of conventional submersible pumps directly in the excavation or temporary trenches to direct the flow of water and to remove water from the excavation. If temporary sump pits are used, we recommend they be established at an elevation 3 to 5 feet below the bottom of the excavation subgrade or bottom of footing. A perforated 55-gallon drum or other temporary structure could be used to house the pump. We recommend continuous dewatering of the excavations using pumps during construction.

If dewater operations are performed at the site, ECS recommends that the dewatering operations be performed in accordance with Local, State and Federal Government regulatory requirements for surface water discharges. ECS would be pleased to be consulted by the client on those requirements, if requested.

5.2 EARTHWORK OPERATIONS

5.2.1 Structural Fill

Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will typically include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships (i.e., Proctors) for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications. Alternatively, Proctor data from other accredited laboratories can be submitted if the test results are within the last 90 days.

Satisfactory Structural Fill Materials: Materials satisfactory for use as structural fill should consist of inorganic soils with the following engineering properties and compaction requirements.

STRUCTURAL FILL INDEX PROPERTIES	
Subject	**Property**
Building and Pavement Areas	LL < 40, PI<20
Max. Particle Size	4 inches
Fines Content	Max. 20 %
Max. organic content	5% by dry weight

STRUCTURAL FILL COMPACTION REQUIREMENTS	
Subject	**Requirement**
Compaction Standard	Standard Proctor, ASTM D698
Required Compaction (Upper 1 foot)	98% of Max. Dry Density
Required Compaction (Depths greater than 1 foot)	95% of Max. Dry Density
Dry Unit Weight	>100 pcf
Moisture Content	-2 to +2 % points of the soil's optimum value
Loose Thickness	8 inches prior to compaction

On-Site Borrow Suitability: Significant natural deposits of suitable soils are present on the site. The onsite near surface sands (SP, SM) with fines contents less than 20 percent and free of detritus material should be fine for re-use as structural fill.

Fill Placement: Fill materials should not be placed on frozen soils, on frost-heaved soils, and/or on excessively wet soils. Borrow fill materials should not contain frozen materials at the time of placement, and frozen or frost-heaved soils should be removed prior to placement of structural fill or other fill soils and aggregates. Excessively wet soils or aggregates should be scarified, aerated, and moisture conditioned.

5.3 FOUNDATION AND SLAB OBSERVATIONS

Slab Subgrade Verification: Prior to placement of a drainage layer, the subgrade should be prepared in accordance with the recommendations found in **Section 5.1.2 Proofrolling**.

5.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally not suitable for support of utility pipes. The pipe subgrades should be observed and probed for stability by ECS. Any loose or unsuitable materials encountered should be removed and replaced with suitable compacted Structural Fill, or pipe stone bedding material.

Utility Backfilling: The granular bedding material (AASHTO #57 stone) should be at least 6 inches thick, but not less than that specified by the civil engineer's project drawings and specifications. We recommend that the bedding materials be placed up to the spring line of the pipe. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for structural fill and fill placement.

Excavation Safety: Excavations and slopes should be constructed and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing, constructing, and maintaining stable temporary excavations and slopes. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 CLOSING

ECS has prepared this report to guide the geotechnical-related design and construction aspects of the project. We performed these services in accordance with the standard of care expected of professionals in the industry performing similar services on projects of like size and complexity at this time in the region. No other representation, expressed or implied, and no warranty or guarantee is included or intended in this report.

The description of the proposed project is based on information provided to ECS by Ms. Kim Gordon of New Hanover County Schools. If any of this information is inaccurate or changes, either because of our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted so we can review our recommendations and provide additional or alternate recommendations that reflect the proposed construction.

We recommend that ECS review the project plans and specifications so we can confirm that those plans/specifications are in accordance with the recommendations of this geotechnical report.

Field observations and quality assurance testing during earthwork and foundation installation are an extension of, and integral to, the geotechnical design. We recommend that ECS be retained to apply our expertise throughout the geotechnical phases of construction, and to provide consultation and recommendation should issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A – Diagrams & Reports

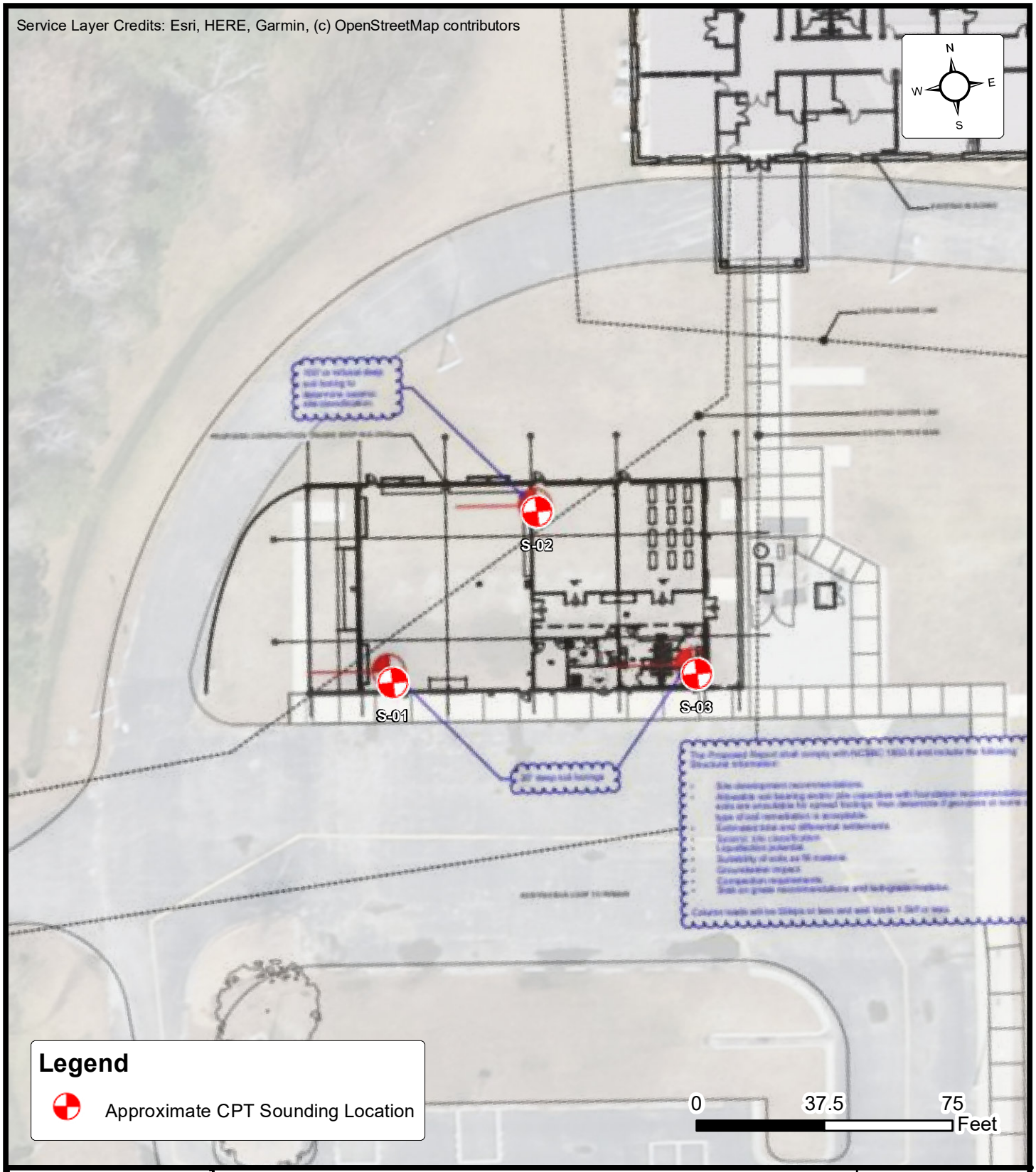
Site Location Diagram
Exploration Location Diagram

SITE LOCATION DIAGRAM
SOUTHEAST AREA TECHNICAL HIGH

5301 SIDBURY ROAD, CASTLE HAYNE, NC

NEW HANOVER COUNTY SCHOOLS

ENGINEER	WEG
SCALE	AS NOTED
PROJECT NO.	22:32654
FIGURE	1 OF 2
DATE	12/20/2022



BORING LOCATION DIAGRAM
SOUTHEAST AREA TECHNICAL HIGH

5301 SIDBURY ROAD, CASTLE HAYNE, NC

NEW HANOVER COUNTY SCHOOLS

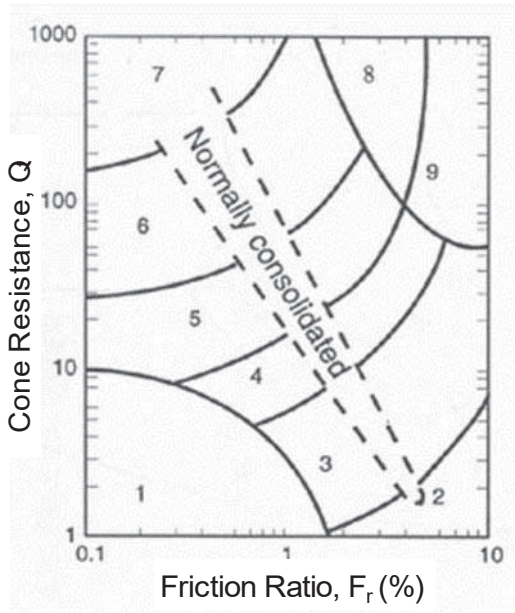
ENGINEER	WEG
SCALE	AS NOTED
PROJECT NO.	22:32654
FIGURE	2 OF 2
DATE	12/20/2022

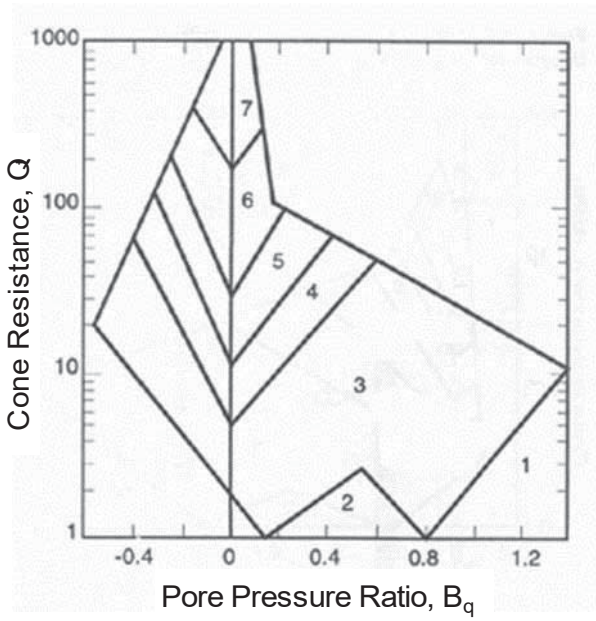
APPENDIX B – Field Operations

Reference Notes for CPT Soundings Logs
Cone Penetration Test Sounding Logs (S-1 through S-3)

REFERENCE NOTES FOR CONE PENETRATION TEST (CPT) SOUNDINGS

In the CPT sounding procedure (ASTM-D-5778), an electronically instrumented cone penetrometer is hydraulically advanced through soil to measure point resistance (q_c), pore water pressure (u_2), and sleeve friction (f_s). These values are recorded continuously as the cone is pushed to the desired depth. CPT data is corrected for depth and used to estimate soil classifications and intrinsic soil parameters such as angle of internal friction, preconsolidation pressure, and undrained shear strength. The graphs below represent one of the accepted methods of CPT soil behavior classification (Robertson, 1990).





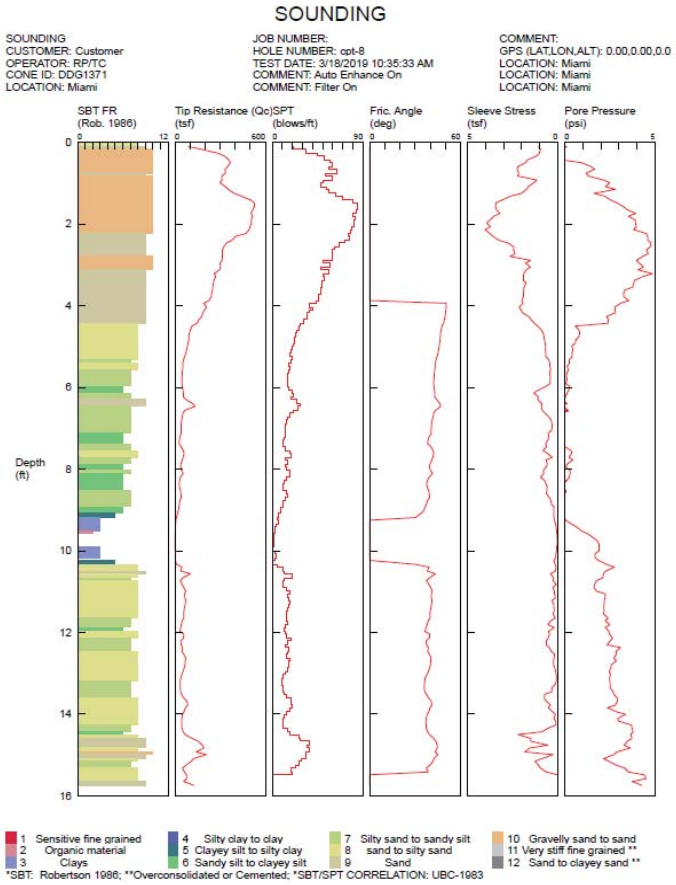
1. Sensitive, Fine Grained
2. Organic Soils-Peats
3. Clays; Clay to Silty Clay
4. Clayey Silt to Silty Clay
5. Silty Sand to Sandy Silt
6. Clean Sands to Silty Sands
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff Fine Grained

The following table presents a correlation of corrected cone tip resistance (q_t) to soil consistency or relative density:

SAND		SILT/CLAY	
Corrected Cone Tip Resistance (q_t) (tsf)	**Relative Density**	**Corrected Cone Tip Resistance (q_t) (tsf)**	**Relative Density**
<20	Very Loose	<5	Very Soft
20-40	Loose	5-10	Soft
40-120	Medium Dense	10-15	Firm
		15-30	Stiff
120-200	Dense	30-45	Very Stiff
>200	Very Dense	45-60	Hard
		>60	Very Hard

SUBSURFACE EXPLORATION PROCEDURE: CONE PENETRATION TESTING (CPT) ASTM D 5778

In the CPT sounding procedure, an electronically instrumented cone penetrometer is hydraulically advanced through soil to measure point resistance (qc), pore water pressure (U2), and sleeve friction (fs). These values are recorded continuously as the cone is pushed to the desired depth. CPT data is corrected for depth and used to estimate soil classifications and intrinsic soil parameters such as angle of internal friction, pre-consolidation pressure, and undrained shear strength.



CPT Procedure:

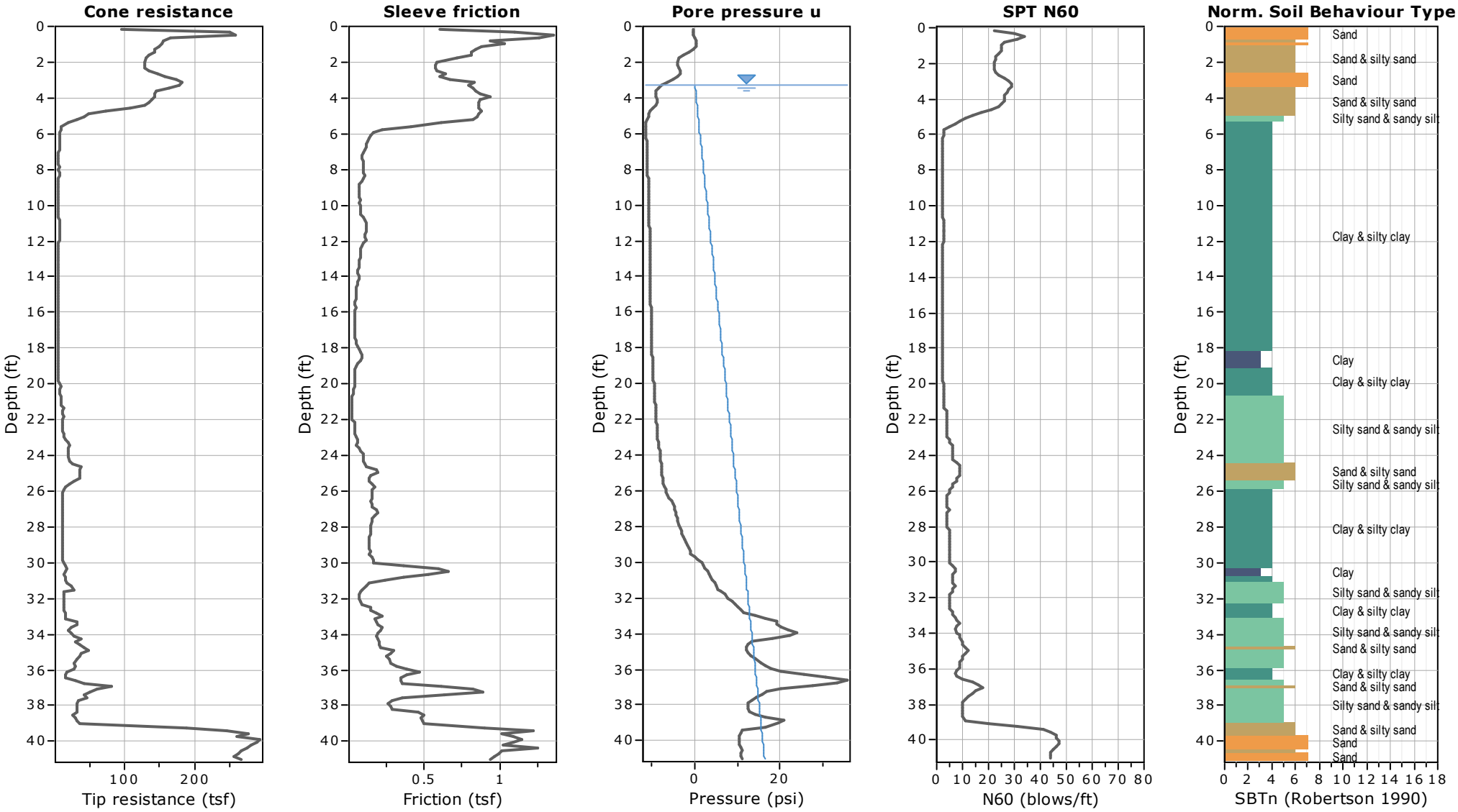
- Involves the direct push of an electronically instrumented cone penetrometer* through the soil
- Values are recorded continuously
- CPT data is corrected and correlated to soil parameters

**CPT Penetrometer Size May Vary*

ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28403
ECS Project # 22-32654

CPT: S-1
Total depth: 41.01 ft, Date: 12/20/2022
Cone Type: Uknown
Cone Operator: Cory Robison

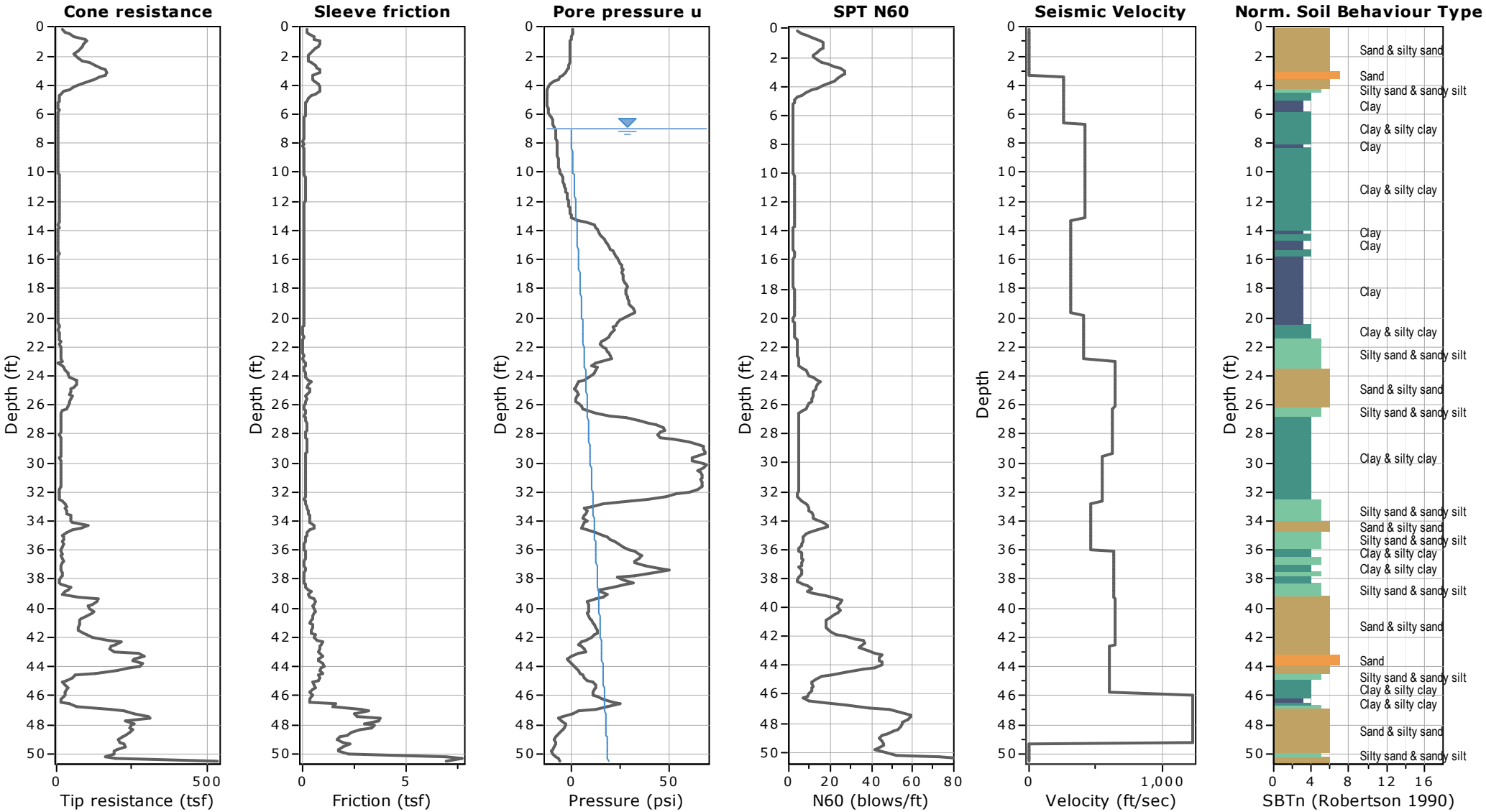
Project: **Southeast Area Technical HS - Addition**
Location: **Castrle Hayne, New Hanover County, North Carolina**



ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28403
ECS Project # 22-32654

CPT: S-2
Total depth: 50.52 ft, Date: 12/20/2022
Cone Type: Uknown
Cone Operator: Cory Robison

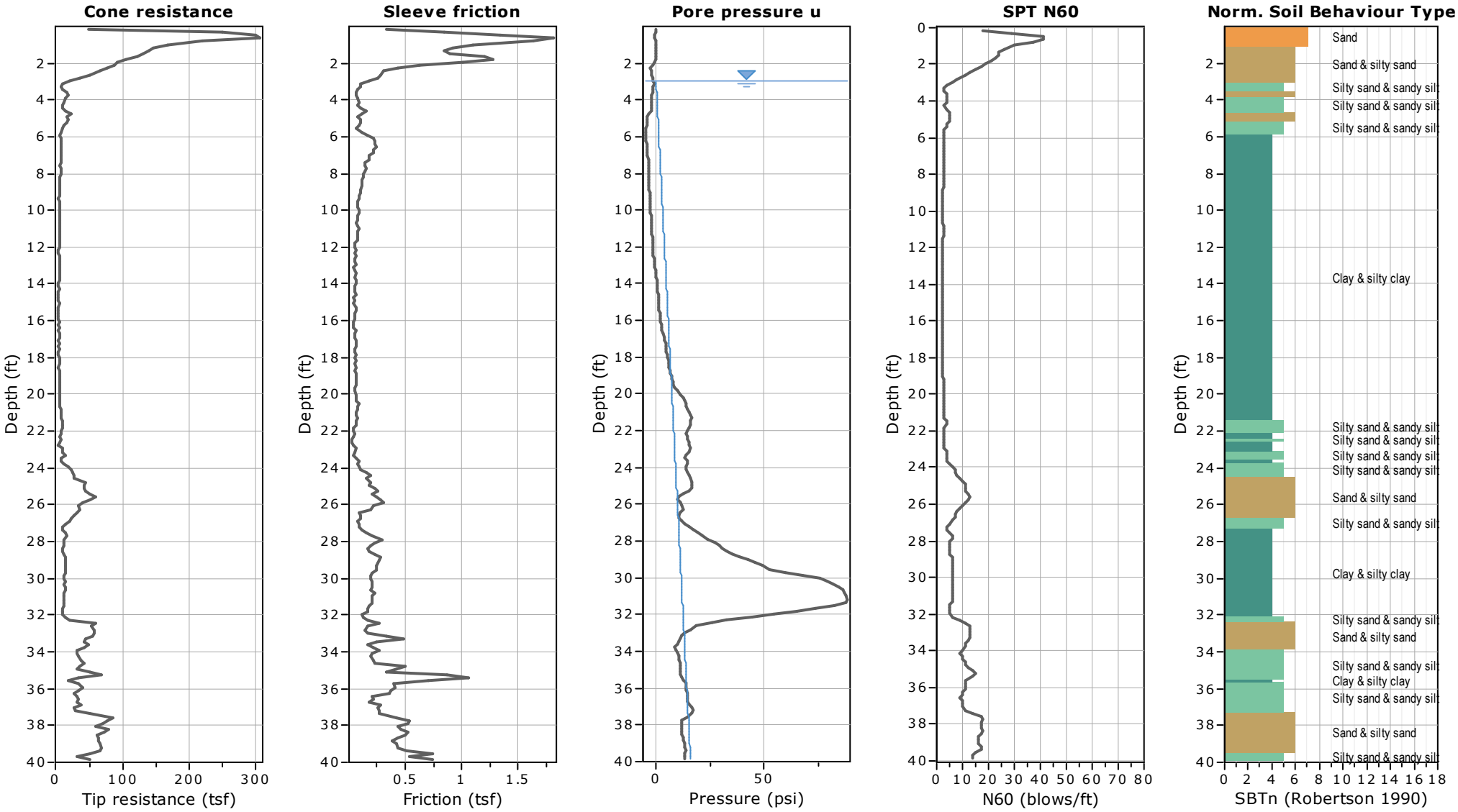
Project: **Southeast Area Technical HS - Addition**
Location: **Castrle Hayne, New Hanover County, North Carolina**



ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28403
ECS Project # 22-32654

CPT: S-3
Total depth: 39.86 ft, Date: 12/20/2022
Cone Type: Uknown
Cone Operator: Cory Robison

Project: **Southeast Area Technical HS - Addition**
Location: **Castrle Hayne, New Hanover County, North Carolina**



APPENDIX C – Supplemental Report Documents

GBA Document

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation*.

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

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SECTION 01 1000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: NHCS Project No. 22-90458 SEA-Tech High School SCIF Grant Renovations & Addition Renovations

B. Owner's Name: New Hanover County Schools.

C. Architect's Name: Sawyer Sherwood & Associate, P.C.

D. The Project consists of the New Construction & Renovation of SEA-Tech High School..

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 4100.

B. Scope of alterations work is indicated on drawings.

C. Plumbing: Alter existing system and add new construction, keeping existing in operation.

D. HVAC: Alter existing system and add new construction, keeping existing in operation.

E. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.

F. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.

G. Telephone: Alter existing system and add new construction, keeping existing in operation.

H. Security System: Alter existing system and add new construction, keeping existing in operation.

I. Contractor shall remove and deliver the following to Owner prior to start of work:
   1. All door hardware.
   2. Any items noted on the drawings.

J. Contractor shall remove and store the following prior to start of work, for later reinstallation by Contractor:
   1. Any item noted on the drawings.

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy the existing building during the entire construction period.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:
   1. Owner occupancy.

C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Utility Outages and Shutdown:
   1. Limit disruption of utility services to hours the building is unoccupied.
   2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.

3. Prevent accidental disruption of utility services to other facilities.

1.06 WORK SEQUENCE

A. Construct Work in phases during the construction period:
   1. Phase 1: New Construction Trades Building & Drainage Improvements.
   2. Phase 2: New Coffee Shop, Classroom Window Modification, and Culinary Classroom Renovation & Expansion.

B. Coordinate construction schedule and operations with Owner.

END OF SECTION 01 1000

SECTION 01 2100
ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Owner allowance.

1.02 CONTINGENCY ALLOWANCE

A. Funds will be drawn from the Contingency Allowance only by Owner's Allowance Expenditure Authorization (AEA).

B. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2100

SECTION 01 2300
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

1.02 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.03 SCHEDULE OF ALTERNATES

A. Alternate No. G-1: Renovation and Expansion of Culinary Classroom.

B. Alternate No. G-2: Coffee Bar.

C. Alternate G-3: Door Hardware - see itemized list below:

D. Alternate No. 3.1: Exit devices by Von Duprin.
   1. Alternate Item: Section 87100.

E. Alternate No. 3.2: Continuous and non-continuouos hinges by Ives.
   1. Alternate Item: Section 87100.

F. Alternate No. 3.3: Locks/latches by Yale.
   1. Alternate Item: Section 87100.

G. Alternate No. 3.4: Cylinder/keyway by Yale.
   1. Alternate Item: Section 87100.

H. Alternate No. 3.5: Door Closers by LCN.
   1. Alternate Item: Section 87100.

I. Alternate No. 3.6: Electronic Locks by Schlage.
   1. Alternate Item: Section 87100.

J. Alternate No. 3.7: AD400s by Schlage

K. Alternate Item: Section 87100.

L. Alternate No. G-4: Cameras to be Panasonic iPro series
   1. Alternate Item: Section --.

M. Alternate No. G-5: Intercom to be by Bogen.
   1. Alternate Item: 27 5116.

N. Alternate No. G-6: Emergency Panic Alarm by United Security Projects.
   1. Alternate Item: Section 28 1600.

O. Alternate No. G-7: Security Alarm system by Honeywell Ademco Vista.
   1. Alternate Item: Section 28 1600-.

P. Alternate No. G-8: Access Video Inercom System by AIPhone
   1. Alternate Item: Section 28 1300.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2300

SECTION 01 2500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 1 - Information for Bidders: Restrictions on timing of substitution requests.

B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.

1.04 REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage) Current Edition.

B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase) Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:
   1. Information for Bidders specifies time restrictions for submitting substitution requests during the bidding period.

B. Submittal Form (before award of contract):

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submit request for Substitution for Cause immedately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

3.04 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.05 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record.

END OF SECTION 01 2500

SECTION 01 3000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Submittals for review, information, and project closeout.

F. Number of copies of submittals.

G. Requests for Interpretation (RFI) procedures.

H. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   2. Submission of initial Submittal schedule.
   3. Designation of personnel representing the parties to Contract, Contractor and Architect.
   4. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   5. Scheduling.

6. Scheduling activities of the Owner's geotechnical engineer and quality control testing agency.

D. Record minutes and distribute copies within two days after meeting to participants, distributed electronically to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.

D. Agenda:
1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Maintenance of quality and work standards.
11. Effect of proposed changes on progress schedule and coordination.
12. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, distributed electronically to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 01 3216

3.04 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:
1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
1. Prepare a separate RFI for each specific item.
   a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
   b. Do not forward requests which solely require internal coordination between subcontractors.
2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Discrete and consecutive RFI number, and descriptive subject/title.
   2. Issue date, and requested reply date.
   3. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   4. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   5. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.

G. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

H. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.

3.05 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Submit at the same time as the preliminary schedule specified in Section - 01 3216 - Construction Progress Schedule.
   2. Format schedule to allow tracking of status of submittals throughout duration of construction.
   3. Arrange information to include scheduled date for initial submittal and specification number and title.
   4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
      a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

b. All material finish and/or color samples shall be submitted prior to Architect making finish/color selections. Schedule delivery of finish/color samples to allow time for Architect to make selections, Owner to approve finishes/colors, and account for product lead times to avoid delays in delivery and/or construction. Additional contract time will not be given for delays related to untimely delivery of finish/color selection samples.

3.06 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below.

3.07 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Certificates.
   3. Test reports.
   4. Inspection reports.
   5. Manufacturer's instructions.
   6. Manufacturer's field reports.
   7. Other types indicated.

3.08 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.
   4. Bonds.
   5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.09 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
   1. After review, produce duplicates.
   2. Retained samples will not be returned to Contractor unless specifically so stated.

3.10 SUBMITTAL PROCEDURES

A. General Requirements:
   1. Use a separate transmittal for each item. Provide an individual submittal for each spec section requiring submittals. Submittals combining information for multiple spec sections will be returned without review or comment.

2. Transmit using approved form.
    a. Use Contractor's form, subject to prior approval by Architect.
3. Sequentially identify each item. For revised submittals use original number and a sequential combination numberical and alphabetical suffix.
4. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be reviewed.
5. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
    a. Send submittals in electronic format via email to Architect.
6. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 14 days excluding delivery time to and from the Contractor.
7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
9. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.11 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
    a. "No Exception Taken", or language with same legal meaning.
    b. "Make Corrections Noted", or language with same legal meaning.
        1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
2. Not Authorizing fabrication, delivery, and installation:
    a. "Revise and Resubmit".
        1) Resubmit revised item, with review notations acknowledged and incorporated.

b. "Rejected".
   1) Submit item complying with requirements of Contract Documents.

END OF SECTION 01 3000

SECTION 01 3216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 01 1000 - Summary: Work sequence.

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule.

B. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

C. Within 10 days after joint review, submit complete schedule.

D. Submit updated schedule with each Application for Payment.

E. Submit in PDF format.

1.04 QUALITY ASSURANCE

A. Contractor's Administrative Personnel: 3 years minimum experience in using and monitoring CPM schedules on comparable projects.

1.05 SCHEDULE FORMAT

A. Sheet Size: 11x17 inches.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

C. Show critical path items in separate color.

3.03 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.04 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

3.05 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 3216

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.

B. Quality assurance submittals.

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Mock-ups.

G. Tolerances.

H. Manufacturers' field services.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittal procedures.

B. Section 01 6000 - Product Requirements: Requirements for material and product quality.

C. See General and Supplementary General Conditions of the Contract: Shop Drawings, Inspection of the Work, Testing, etc.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Data: Where drawings or specifications require delegated design submittals, Contractor shall employ and pay for the services of a design professional, licensed to practie in the state where the project is located. Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
   1. Include required product data and shop drawings.
   2. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
   3. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
   1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing and inspection.

B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services, or as required by testing agency for specific services. If Contractor has given notification testing/inspection services, and services need to be delayed or canceled, Contractor shall contact testing agency 24 hours before scheduled time of services or shall be required to pay for the canceled visit.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION 01 4000

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary telecommunications services.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Security requirements.

F. Vehicular access and parking.

G. Waste removal facilities and services.

H. Field offices.

1.02 RELATED REQUIREMENTS

A. Section 01 5813 - Temporary Project Signage.

1.03 TEMPORARY UTILITIES

A. Contractor will provide the following:
   1. Electrical power, consisting of metered connection paid for by the contractor for the job trailer (throughout the project) and construction of the Constructions Trades Building.
   2. Water supply, conisting of metered connection paid for by the ccontractor for the job trailer (throughout the project) and the construcion of the Constructions Trades Building.

B. Owner will provide the following:
   1. Electrical power, consisting of connection to existing for interior renovations.
   2. Water supply, consisting of connection to existing for interior renovations.

C. Use trigger-operated nozzles for water hoses, to avoid waste of water.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization. Mobile devices with access to internet/e-mail will be adequate.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide protection for plants designated to remain. Replace damaged plants.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.08 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as needed to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1.09 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.10 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site weekly.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

1.11 PROJECT SIGNS - SEE SECTION 01 5813

1.12 FIELD OFFICES - SEE SECTION 01 5213

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 8 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Clean and repair damage caused by installation or use of temporary work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 5000

SECTION 01 5213
FIELD OFFICES AND SHEDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary field offices for use of Contractor.

B. Maintenance and removal.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls:

PART 2 PRODUCTS

2.01 CONSTRUCTION

A. Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations, with steps/ramps and landings at entrance doors.

B. Construction: Structurally sound, secure, weather tight enclosures for office. Maintain during progress of Work; remove at completion of Work.

C. Fire Extinguishers: Appropriate type fire extinguisher at each office.

2.02 ENVIRONMENTAL CONTROL

A. Heating, Cooling, and Ventilating: Automatic equipment to maintain comfort conditions.

2.03 CONTRACTOR OFFICE AND FACILITIES

A. Size: For Contractor's needs and to provide space for project meetings.

B. Telephone: As specified in Section 01 5000.

C. Furnishings in Meeting Area: Conference table and chairs to seat at least eight persons; racks and files for Contract Documents, submittals, and project record documents.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install office spaces ready for occupancy 15 days after date fixed in Notice to Proceed.

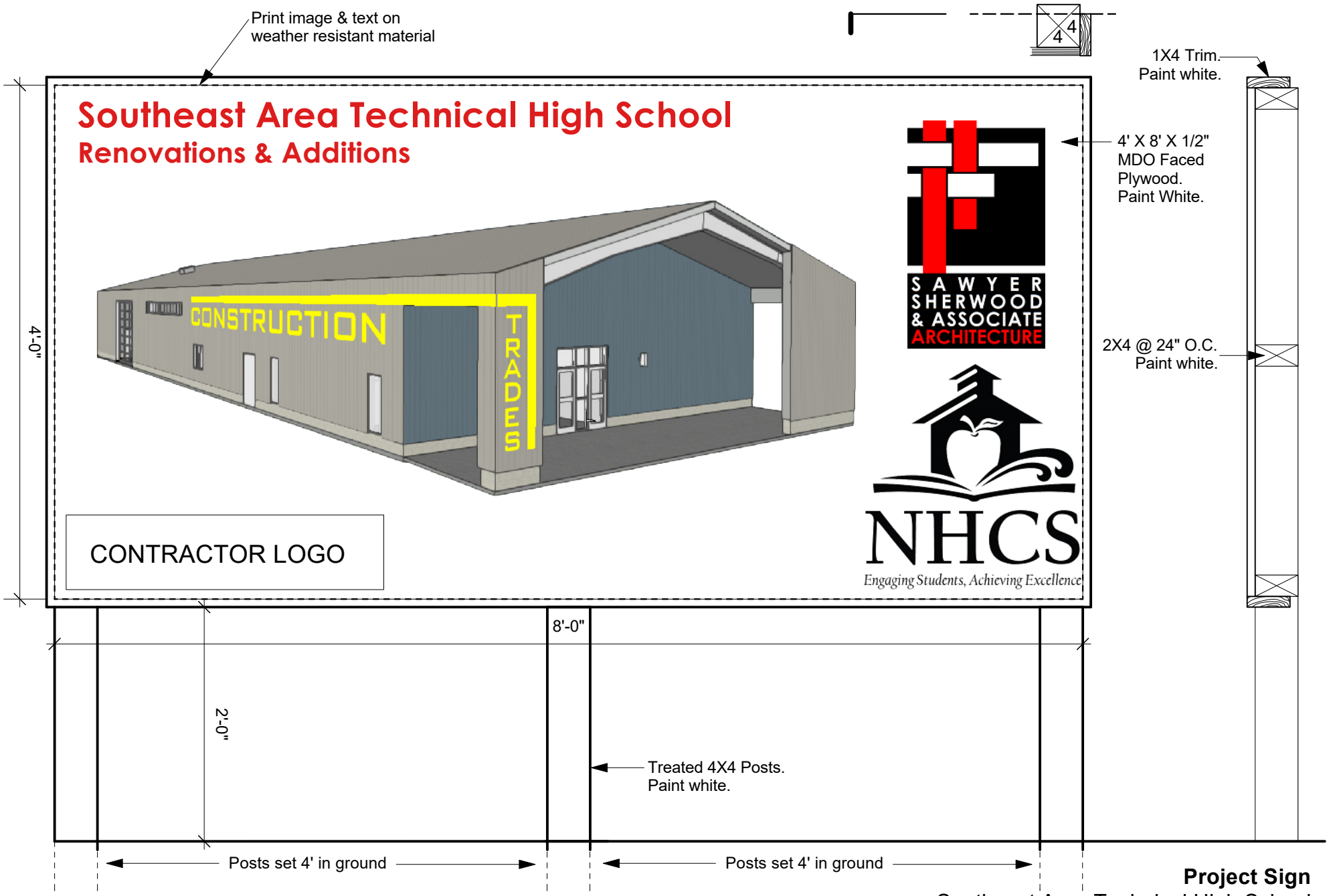
3.02 MAINTENANCE AND CLEANING

A. Weekly janitorial services for offices; periodic cleaning and maintenance for offices.

3.03 REMOVAL

A. At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

END OF SECTION 01 5213



Project Sign
Southeast Area Technical High School

SECTION 01 5813
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Responsibility to provide signs.

B. See General Conditions of the Contract for other signage-related requirements.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: New, wood, structurally adequate.

B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, standard large sizes to minimize joints.

2.02 PROJECT IDENTIFICATION SIGN

A. One painted sign of construction, design, and content indicated on drawings, location designated.

B. Content:

1. As shown in the drawing on the following page. Background artwork to be provided by Architect. Text and logos to include:
   a. Project number, title, logo, and name of Owner as indicated on Contract Documents.
   b. Graphic design, colors, style of lettering as designated by Architect.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install project identification sign within 30 days after date fixed by Notice to Proceed.

B. Erect at location of high public visibility adjacent to main entrance to site.

C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.

D. Install sign surface plumb and level, with butt joints. Anchor securely.

E. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION 01 5813

SECTION 01 6000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

B. Section 01 4000 - Quality Requirements: Product quality monitoring.

C. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

1. Containing asbestos.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

   1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.

F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

G. For exterior storage of fabricated products, place on sloped supports above ground.

H. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

I. Comply with manufacturer's warranty conditions, if any.

J. Do not store products directly on the ground.

K. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

L. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

M. Prevent contact with material that may cause corrosion, discoloration, or staining.

N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 6000

SECTION 01 7000
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Cleaning and protection.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures and interior partitions.

E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 7900 - Demonstration and Training: Demonstration of products and systems and where indicated in specific specification sections.

G. Section 02 4100 - Demolition: Selective demolition; site utility demolition.

1.03 QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.04 PROJECT CONDITIONS

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

1. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

1.05 COORDINATION

A. See Section 01 1000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

E. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

F. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

G. Utilize recognized engineering survey practices.

H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations; and _____.
   2. Grid or axis for structures.
   3. Building foundation, column locations, ground floor elevations, and _____.

I. Periodically verify layouts by same means.

J. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 .

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Relocate items indicated on drawings.

3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
   b. See Section 01 1000 for other limitations on outages and required notifications.
   c. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment of dust caused by construction operations.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.07 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
   1. Complete the work.
   2. Fit products together to integrate with other work.
   3. Provide openings for penetration of mechanical, electrical, and other services.
   4. Match work that has been cut to adjacent work.
   5. Repair areas adjacent to cuts to required condition.
   6. Repair new work damaged by subsequent work.
   7. Remove samples of installed work for testing when requested.
   8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:
   1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
   2. Match color, texture, and appearance.
   3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

B. Testing, adjusting, and balancing HVAC systems: See Section 23 0500 - Heating and Air Conditioning.

3.12 FINAL CLEANING

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

END OF SECTION 01 7000

SECTION 01 7419
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

B. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

C. Methods of trash/waste disposal that are not acceptable are:
   1. Burning on the project site.
   2. Burying on the project site.
   3. Dumping or burying on other property, public or private.
   4. Other illegal dumping or burying.

D. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

D. Section 01 7000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

PART 3 EXECUTION

2.01 WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

END OF SECTION 01 7419

SECTION 01 7800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. General and Supplementary General Conditions of the Contract: Performance bond, labor and material payment bonds, warranty and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit construction document markups to Architect for review and use in producing record documents for the Owner.

B. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

C. Operation and Maintenance Data:
   1. Submit electronic copy of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. Submit one copy of completed documents 15 days prior to Substantial Completion. This copy will be reviewed and returned prior to Substantial Completion, with Architect comments. Revise content of all document sets as required prior to final submission.
   4. Submit two sets of revised final documents in final form within 10 days after final inspection.

D. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawingsand Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Additional information as specified in individual product specification sections.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Include test and balancing reports.

L. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

3.06 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION 01 7800

SECTION 01 7900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. HVAC systems and equipment.
   2. Plumbing equipment for fire sprinkler system.
   3. Electrical systems and equipment.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Finishes, including flooring.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit not less than four weeks prior to start of training.
   2. Revise and resubmit until acceptable.
   3. Provide an overall schedule showing all training sessions.
   4. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
   1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
   2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
   1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

C. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
   1. The location of the O&M manuals and procedures for use and preservation; backup copies.
   2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
   3. Typical uses of the O&M manuals.

D. Product- and System-Specific Training:
   1. Review the applicable O&M manuals.
   2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
   3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
   4. Provide hands-on training on all operational modes possible and preventive maintenance.
   5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
   6. Discuss common troubleshooting problems and solutions.
   7. Discuss any peculiarities of equipment installation or operation.
   8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
   9. Review recommended tools and spare parts inventory suggestions of manufacturers.
   10. Review spare parts and tools required to be furnished by Contractor.
   11. Review spare parts suppliers and sources and procurement procedures.

E. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 7900

SECTION 02 4100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 1000 - Summary: Sequencing and staging requirements.

C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Site Plan: Indicate:
   1. Areas for temporary construction and field offices.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 3 EXECUTION

2.01 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with requirements in Section 01 7000.

B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
   5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   6. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
   7. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
   8. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.

C. Do not begin removal until receipt of notification to proceed from Owner.

D. Do not begin removal until built elements to be salvaged or relocated have been removed.

E. Protect existing structures and other elements to remain in place and not removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

F. Hazardous Materials:
   1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

G. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

2.02 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without 7 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Existing construction and utilities indicated on drawings are based on casual field observation and existing record documents only.
   1. Verify construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Maintain weatherproof exterior building enclosure, except for interruptions required for replacement or modifications; prevent water and humidity damage.

C. Remove existing work as indicated and required to accomplish new work.
   1. Remove items indicated on drawings.

D. Services including, but not limited to, HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications: Remove existing systems and equipment as indicated.
   1. Maintain existing active systems to remain in operation, and maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings. Remove back to source of supply where possible, otherwise cap stub and tag with identification.

E. Protect existing work to remain.
   1. Prevent movement of structure. Provide shoring and bracing as required.
   2. Perform cutting to accomplish removal work neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch to match new work.

2.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 4100

SECTION 03 3000
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 includes 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.

B. Related Sections:

1. Division 32 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 ACTION 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. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

E. Samples: For vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Curing compounds.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.6 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. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5."
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

    a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
    b. 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.

G. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. 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 concrete finish subcontractor.

2. Review 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, 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.
3. Review floor finishes to be installed and coordinate with curing methods to be used.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

C. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. 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.

2.4 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. Supplement with the following:

a. Fly Ash: ASTM C 618, Class 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. Water: ASTM C 94/C 94M and potable.

2.5 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: Subject to compliance with requirements, products that may be incorporated into the Work include the following:

a. Axim Italcementi Group, Inc.; CATEXOL CN-CI
b. BASF Construction Chemicals - Building Systems; Rheocrete CNI
c. Euclid Chemical Company (The), an RPM company; ARRMATECT, EUCON BCN, or EUCON CIA
d. Grace Construction Products, W. R. Grace & Co.; DCI

e. Sika Corporation; Sika CNI

2.6 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. Maximum perm rating of 0.02.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fortifiber Building Systems Group; Moistop Ultra 15

b. Grace Construction Products, W. R. Grace & Co.; Florprufe 120

c. Insulation Solutions, Inc.; Viper VaporCheck II

d. Meadows, W. R., Inc.; Perminator 15 mil

e. Raven Industries Inc.; Vapor Block 15

f. Reef Industries, Inc.; Griffolyn 15 mil Green

g. Stego Industries, LLC; Stego Wrap 15 mil Class A

2. Provide manufacturer's compatible sealer system for penetrations.

B. Granular Fill: Provide one of the following:

a. 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.

b. Clean sands with less than 5 % passing the #200 sieve. Materials to be verified by a qualified Geotechnical Engineer.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Construction Chemicals - Building Systems; Confilm

b. ChemMasters; SprayFilm

c. Conspec by Dayton Superior; Aquafilm

d. Dayton Superior Corporation; Sure Film (J-74)

e. Euclid Chemical Company (The), an RPM company; Eucobar

f. L&M Construction Chemicals, Inc.; E-CON

g. Meadows, W. R., Inc.; EVAPRE

h. Sika Corporation; SikaFilm

i. Symons by Dayton Superior; Finishing Aid

j. Unitex; PRO-FILM

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: Subject to compliance with requirements, provide one of the following:

   a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
   b. BASF Construction Chemicals - Building Systems; Kure 200.
   c. ChemMasters; Safe-Cure Clear.
   d. Conspec by Dayton Superior; W.B. Resin Cure.
   e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
   f. Edoco by Dayton Superior; Res X Cure WB.
   g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
   h. Kaufman Products, Inc.; Thinfilm 420.
   i. Lambert Corporation; AQUA KURE - CLEAR.
   j. L&M Construction Chemicals, Inc.; L&M Cure R.
   k. Meadows, W. R., Inc.; 1100-CLEAR.
   l. Nox-Crete Products Group; Resin Cure E.
   m. Right Pointe; Clear Water Resin.
   n. SpecChem, LLC; Spec Rez Clear.
   o. Symons by Dayton Superior; Resi-Chem Clear.
   p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
   q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.8 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

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/C 1059M, 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.

2.9 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/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface 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.

2.10 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: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 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.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Slump Limit: 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.

B. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength – typical interior slab: 3000 psi at 28 days.
2. Minimum Compressive Strength – typical exterior slab: 4000 psi (27.6 MPa) at 28 days.
3. Slump Limit: 4 inches, plus or minus 1 inch.
4. Air Content: For exterior broom finished concrete only; 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, 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.

PART 3 - EXECUTION

3.1 FORMWORK

A. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

B. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. 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.

E. 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.

F. 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.

G. Chamfer exterior corners and edges of permanently exposed concrete.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. 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."

3.3 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Following leveling and tamping of granular base for slabs on grade, place vapor barrier sheeting with longest dimension parallel with direction of pour and face laps away from the expected direction of the placement whenever possible.
2. Extend vapor barrier to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the foundation wall, grade beam or slab itself.
3. Lap joints 6 inches and seal with manufacturer's recommended tape.
4. Apply seam tape to a clean and dry vapor barrier.
5. Seal all penetrations (including pipes) per manufacturer’s instructions.
6. Avoid the use of non-permanent stakes driven through vapor retarder.
7. If non-permanent stakes are driven through vapor retarder, repair as recommended by vapor retarder manufacturer.
8. Repair damaged areas with vapor barrier material of similar (or better) permeance, puncture and tensile.

3.4 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/D 1.4M, 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.

3.5 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. Use a bonding agent 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.

3.6 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. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. 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.

D. 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.

E. 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.

F. 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.

G. Hot-Weather Placement: Comply with ACI 301 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.

3.7 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 or to be covered with a coating or covering material applied directly to concrete.

C. 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.

3.8 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 one direction.

1. Apply scratch finish to surfaces indicated and 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.

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 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) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces 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, 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 with Architect before application.

3.9 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. 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.

3.10 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. Removal: 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.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.12 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 to solid concrete. Limit cut depth to 3/4 inch. 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.

3.13 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. 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.

D. 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: Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, nor less than once for each 50 cu. yd. of concrete, nor less than once for each 5,000 sq. ft. of surface area for slabs or walls.

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; 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/C 1064M; 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/C 31M.
    a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
7. 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.
8. 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.
9. 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.
10. 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.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

END OF SECTION 033000

SECTION 03 3511
CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Liquid densifiers and hardeners.

B. Concrete stains and dyes.

C. Clear coatings.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.

PART 2 PRODUCTS

2.01 CONCRETE FLOOR FINISH APPLICATIONS

A. Unless otherwise indicated, all concrete floors are to be finished using liquid densifier/hardener.

B. Liquid Densifier and Hardener:
   1. Use at following locations: Interior concrete floors; See Finish Schedule.

C. Concrete Stain:
   1. Use at following locations: Interior concrete floors; See Finish Schedule.

D. Clear Coating:

2.02 DENSIFIERS AND HARDENERS

A. Liquid Densifier and Hardener: Penetrating chemical compound that reacts with concrete, filling the pores, hardening, and dustproofing.
   1. Composition: Lithium silicate.
   2. Products:
      a. Euclid Chemical Company; ULTRASIL LI+: www.euclidchemical.com/#sle.
      b. Kaufman Products Inc; SureHard LS: www.kaufmanproducts.net/#sle.
      c. PROSOCO, Inc; Consolideck LS: www.prosoco.com/consolideck/#sle.
      d. SpecChem, LLC; LithSeal SC: www.specchemllc.com/#sle.
      e. W. R. Meadows, Inc; Liqui-Hard Ultra: www.wrmeadows.com/#sle.
      f. Substitutions: See Section 01 6000 - Product Requirements.

2.03 COATINGS

A. Concrete Stain or Dye: Translucent, penetrating compound for interior or exterior use; must be finished with a topical sealer.

B. High Gloss Clear Coating: Transparent, nonyellowing, acrylic polymer-based coating.
   1. Composition: Solvent-based.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.

B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.

B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.

C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.

D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

END OF SECTION 03 3511

SECTION 04 2000
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.

B. Mortar and grout.

C. Reinforcement and anchorage.

D. Flashings.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Insulation for cavity spaces.

B. Section 07 2500 - Weather Barriers: Water-resistive barriers applied to exterior face of backing sheathing or unit masonry substrate.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

D. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

B. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement 2022.

C. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete 2022.

D. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units 2022.

E. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units 2022.

F. ASTM C150/C150M - Standard Specification for Portland Cement 2022.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry 2019a, with Editorial Revision.

H. ASTM C404 - Standard Specification for Aggregates for Masonry Grout 2018.

I. ASTM C476 - Standard Specification for Grout for Masonry 2023.

J. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete 2016.

K. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength 2022.

L. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms 2023.

M. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry 2020.

N. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing 2017.

O. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls 2017.

P. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures 2022.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Manufacturer's Certificate: Certify that water repellent admixture manufacturer has certified masonry unit manufacturer as an approved user of water repellent admixture in the manufacture of concrete block.

D. Test Reports: Concrete masonry manufacturer's test reports for units with integral water repellent admixture.

1.05 QUALITY ASSURANCE

A. Comply with provisions of ACI 530.1/ASE6/TMS 602, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Manufacturers:
   1. Adams: www.adamsproducts.com
   2. Carolina Prestress: www.carolinaprestress.com
   3. Fay Block: www.fayblock.com
   4. Johnson Concrete: www.johnsoncmu.com

B. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Load-Bearing Units: ASTM C90, normal weight.
      a. Both hollow and solid block, as indicated.
      b. Exposed Faces: Special color and texture where indicated, as follows: split faced.
   3. Nonloadbearing Units: ASTM C129.
      a. Both hollow and solid block, as indicated.
      b. Manufacturers:
   4. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid admixture added to concrete masonry units at the time of manufacture.
      a. Performance of Units with Integral Water Repellent:
         1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
            (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
         2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
         3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
      b. Use only in combination with mortar that also has integral water repellent admixture.
      c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

B. Grout Aggregate: ASTM C404.

C. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

1. Color(s): As selected by Architect from manufacturer's full range.

D. Water: Clean and potable.

E. Moisture-Resistant Admixture: Water repellent compound designed to reduce capillarity.

F. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Use only in combination with masonry units manufactured with integral water repellent admixture.
   2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
   3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: Type and size indictated on drawings.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss, with adjustable ties or tabs spaced at 16 in on center.
   2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
   3. Size: 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inchwire, width of components as required to provide not less than 5/8 inch of mortar coverage from each masonry face.

D. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

2.04 FLASHINGS

A. Metal Flashing Materials: Copper, as specified in Section 07 6200.

B. Combination Nonasphaltic Flashing Materials - Copper:
   1. Copper/Fiberglass Fabric Flashing: 3 oz/sq ft copper sheet laminated between two sheets of fiberglass fabric.

2.05 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.

C. Weeps:

D. Cavity Vents:
   1. Type: Extruded propylene with honeycomb design.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.06 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

3.05 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.06 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.07 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

3.08 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.

C. Extend metal flashings to within 1/2 inch of exterior face of masonry.

3.09 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.10 CLEANING

A. Clean soiled surfaces with cleaning solution.

END OF SECTION 04 2000

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Hardware.

D. Factory finishing.

E. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 12 3600 - Countertops.

1.03 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.

C. Product Data: Provide data for hardware accessories.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Wood Veneer Faced Cabinet:
   1. Exposed Surfaces: HPVA HP-1 Grade A, Birch, rift cut and comb grain, slip-matched.
   2. Semi-Exposed Surfaces: HPVA HP-1 Grade B, Birch, rift cut and comb grain, slip-matched.
   3. Concealed Surfaces: Manufacturer's option.

C. Cabinets at Coffee Bar:
   1. Finish - Exposed Exterior Surfaces: Wood.
   2. Finish - Exposed Interior Surfaces: Wood.

3. Finish - Semi-Exposed Surfaces: Wood
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
6. Casework Construction Type: Type A - Frameless.
7. Interface Style for Cabinet and Door: Style 1 - Overlay; reveal overlay.
8. Grained Face Layout for Cabinet and Door Fronts: Flush panel.
   a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.
9. Adjustable Shelf Loading: 40 psf.
10. Cabinet Style: Flush overlay.
11. Cabinet Doors and Drawer Fronts: Flush style.
12. Drawer Side Construction: Multiple-dovetailed.
13. Drawer Construction Technique: Dovetail joints.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Hardwood Edgebanding: Use solid hardwood edgebanding matching species, color, grain, and grade for exposed portions of cabinetry.

2.03 HARDWOOD PLYWOOD PANELS

A. Hardwood Plywood: Plywood manufactured for nonstructural decorative applications; consisting of faces and backs applied to a variety of core types; comply with HPVA HP-1.
   1. Woodwork Quality Standard: Panels complying with specified woodwork quality standard.
   2. Face: Birch; rift-cut; grade A.
      a. Finish: UV-cured clear topcoat.
   3. Back: Birch; rift-cut.
      a. Finish: UV-cured clear topcoat.
   4. Core, Veneer Core:
      a. Construction and Thickness: 7 plies, 3/4 inch.

2.04 COUNTERTOPS

A. Countertops: See Section 12 3600.

2.05 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

D. Concealed Joint Fasteners: Threaded steel.

E. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

2.06 HARDWARE

A. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch spacing adjustments.

B. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers.

C. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

D. Drawer Slides:
   1. Type: Full extension with overtravel.
   2. Static Load Capacity: Heavy Duty grade.
   3. Mounting: Side mounted.
   4. Features: Provide self closing/stay closed type.

5. Manufacturers:
    a. Accuride International, Inc; ____: www.accuride.com/#sle.
    b. Blum, Inc: www.blum.com/#sle.
    c. Grass America Inc: www.grassusa.com/#sle.
    d. Hettich America, LP: www.hettich.com/#sle.
    e. Knape & Vogt Manufacturing Company: www.knapeandvogt.com/#sle.
    f. Substitutions: See Section 01 6000 - Product Requirements.

E. Hinges: European style concealed self-closing type, steel with nickel-plated finish.
1. Manufacturers:
    a. Blum, Inc: www.blum.com/#sle.
    b. Grass America Inc: www.grassusa.com/#sle.
    c. Hettich America, LP: www.hettich.com/#sle.

2.07 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Provide cutouts for plumbing fixtures, outlet boxes, and fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal cut edges.

2.08 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
1. Transparent:
    a. Oil-Based Polyurethane.
    b. Sheen: Satin.
    c. Products:
        1) Minwax Fast-Drying Polyurethane: www.minwax.com/#sle
        2) Rust-Oleum Varathane: www.rustoleum.com/#sle
        3) ZAR Interior Oil Base Poly: www.zar.com/#sle
        4) Substitutions: Section 01 6000 - Product Requirements.
    d. Coat all exposed plywood faces and edges. Follow manufacturer's recommended application sequence and number of coats.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Secure cabinets to floor using appropriate angles and anchorages.

E. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION 06 4100

SECTION 07 2100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind CMU veneer wall finish.

B. Metal building insulation system consistin of unfaced, uncompressed fiberglass batts, with liner, to fill girt and perlin spaces.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Brick ties and insulation retainers for mineral fiber board insulation behind masonry veneer.

B. Section 09 2116 - Gypsum Board Assemblies: Acoustic batt insulation at interior wall construction.

C. Section 13 3419 - Metal Building Systems: Coordination of detailing for installation of metal building insulation system. Thermal blocks and thermal tape installed as part of metal building system.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

E. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings 2019 (Reapproved 2022).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

G. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.

H. ICC-ES AC239 - Acceptance Criteria for Termite-Resistant Foam Plastic 2008, with Editorial Revision (2014).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.05 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

B. Do not install fiberglass batt insulation until building has been dried in. Remove any batt insulation that gets wet, and replace with new insulation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation at Perimeter of Foundation: Mineral fiber board, termite-resistant.

B. Insulation Inside Masonry Cavity Walls: Mineral fiber board.

C. Insulation in Metal Building System Walls and Roof: Unfaced, uncompressed fiberglass batt insulaiton to fill girt and purlin spaces, with perforated, non-vapor-retarding liner.

2.02 FIBERBOARD INSULATION MATERIALS

A. Rigid Mineral Wool Insulation: Rigid mineral fiber, in accordance with ASTM C612.
   1. Facing: None, unfaced.
   2. Flame Spread Index: 25 or less, when tested with facing, if any, in accordance with ASTM E84.
   3. Smoke Developed Index: 50 or less, when tested with facing, if any, in accordance with ASTM E84.
   4. Board Size: Rigid mineral wool board insulation is available in a range of sizes from various manufacturers. The work includes installation behind CMU veneer. Insulation behind CMU veneer shall be sized to fit between brick ties located at 16 inches on center. If Contractor bids insulation from manufacturers that do not offer boards in sizes matching brick tie spacing, bids shall include labor required to cut insulaiton boards to the correct size.
   5. Board Thickness: 2 inches.
   6. Board Edges: Square.
   7. Thermal Resistance: R-Value of 8.4.
   8. Products:
      a. Johns Manville; CladStone 45: www.jm.com/#sle.
      b. Owens Corning Corporation; Thermafiber Rainbarrier 45: www.ocbuildingspec.com/#sle.
      c. ROCKWOOL (ROXUL, Inc); CAVITYROCK: www.rockwool.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 BATT INSULATION MATERIALS

A. Where batt insulation is indicated, either glass fiber or mineral fiber batt insulation may be used, at Contractor's option.

B. Glass or Mineral Fiber Batt Insulation, at Metal Building Systems: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
   4. Thermal Resistance: R-value of 30, minimum (10 inch, nominal); R-value of 19, minimum (6.5 inch, nominal); and R-value of 11, minium (3.5 inch, nominal).
   5. Facing: Unfaced.
   6. Products:
      a. CertainTeed Corporation; Metal Building Insulation: www.certainteed.com/#sle.
      b. Johns Manville; PEBS Unfaced Filler Blanket: www.jm.com/#sle.
      c. Knauf North America; Metal Building Insulation: www.knaufnorthamerica.com.
      d. Owens Corning Corporation; EcoTouch Certified R Metal Building Insulation: www.ocbuildingspec.com/#sle.
      e. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Thermal Break Tape installed on the exterior flange of the girts prior to install metal wall panels.

B. Liner for Metal Building Insulation System: Interior liner fabric and support strapping for installation of batt insulation in metal buildings.

1. Steel Straps: 100 KSI minimum yield high tensile strength steel, galvanized, primed and painted to the specified color on exposed side with a clear coat primer on the unexposed side. Minimum size shall be 0.02 inch x 1 inch x continuous length.
2. Insulation Hangers: Galvanized steel strips with barbed insulation retainers for conditions recommended by insulation system manufacturer.
3. Liner Fabric: Woven reinforced yarns coated on both sides with a continuous film and perforated to allow vapor transmission. The fabric shall comply with UL 723 or ASTM E84, and be Class A compliant with a low flame spread index of 25 or less based on ASTM E84 standards. Color shall be white.
4. Products: Thermal Design; Simple Saver System Retrofit: www.thermaldesign.com.
   a. Owens Corning; Retrofit Optoliner: www.owenscorning.com.
   b. Thermal Design; Simple Saver System Retrofit: www.thermaldesign.com.
   c. Silvercote; Energy Saver Retrofit Wall: www.silvercote.com.
   d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of irregularities.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards horizontally on interior of CMU perimeter.
   1. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 INSULATION HANGERS

A. Install within girt cavity to support and hold fiberglass wall insulation, may require installation prior to or at the same time as the metal wall panels.

3.04 THERMAL TAPE

A. Install on the exterior flange of teh girts prior to installing metal wall panels. This prevents thermal conductivity from metal panel to metal girts.

3.05 THERMAL BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in roof spaces without gaps or voids. Install R-11 unfaced batt insulation between perlins and metal roofing in coordination with thermal spacers. Install R-19 unfaced insulation between perlins and between R-11 insulation and fabric liner system.

C. Install in wall spaces without gaps or voids. Install R-30 unfaced batt insulation between girts to fill space between wall panel and fabric liner system or face of plywood/gypsum wall board. p

D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

E. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment. Replace insulation that gets wet or dirty prior to its concealment.

END OF SECTION 07 2100

SECTION 07 2500
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-resistive barriers.

1.02 RELATED REQUIREMENTS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.03 DEFINITIONS

A. Water-Resistive Barrier: A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

1.04 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.

B. ASTM D5590 - Standard Test Method for Determining the Resistance of Paint Films and Related Coatings to Fungal Defacement by Accelerated Four-Week Agar Plate Assay 2017 (Reapproved 2021).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).

E. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing 2015.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

PART 2 PRODUCTS

2.01 WATER-RESISTIVE BARRIER MATERIALS

A. Water-Resistive Barrier Coating: Fluid applied, UV-resistant coating for use over various types of exterior sheathing, CMU, and precast concrete in accordance with ICC-ES AC212.
   1. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method.
   2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 120 days of weather exposure.
   3. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, Class A when tested in accordance with ASTM E84.
   4. Resistance to Fungal Growth: No growth when tested in accordance with ASTM D5590.
   5. Joint Preparation Treatment: As recommended by coating manufacturer.
   6. Products:
      a. Henry Company; Air-Block 17MR: www.henry.com/#sle.
      b. Master Wall, Inc; Rollershield LAB System: www.masterwall.com/#sle.
      c. Parex USA, Inc; Parex USA WeahterSeal Spray & Roll-on: www.parexusa.com/sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories Used for Sealing Water-Resistive Barrier and Adjacent Substrates: As indicated or complying with water-resistive barrier manufacturer's installation instructions.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and weather barrier materials.

C. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
   1. Width: 4 inches.

D. Liquid Flashing: One part, fast curing, nonsag, elastomeric, gun grade, trowelable liquid flashing.

E. Thinners and Cleaners: As recommended by water-resistive barrier manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

3.03 INSTALLATION

A. Upon opening exisiting walls to view and prior to new construction, verify existing weather barrier is compatable with products being specified. If exisitng conditions are not compatable notify Architect prior to comencing new work.

B. Install materials in accordance with manufacturer's installation instructions.

C. Water-Resistive Barriers: Install continuous water-resistive barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

D. Coatings:
   1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
   2. Where exterior masonry veneer is being applied, install masonry anchors prior to placement of water-resistive barrier over masonry substrate; seal airtight around anchors.
   3. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.

E. Openings and Penetrations in Exterior Water-Resistive Barriers:
   1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
   3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
   4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
   5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.
   6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 07 2500

SECTION 07 4113
METAL ROOF & WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal roof panel system of preformed steel panels.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Full depth for Metal Buidling System.

B. Section 13 3116-Metal Building Systems.

C.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

B. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2022.

C. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference 2005 (Reapproved 2017).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.
   1. Include typical panel joint in sample.
   2. Include typical fastening detail.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least five years of documented experience.

B. Installer Qualifications: Company trained and authorized by roofing system manufacturer with minium of 5 years experience on projects similar in size and scope.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 5-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Metal Roof Panel Manufacturers:
   1. MBCI; Lokseam: www.mbci.com/products/lokseam - Basis of Design
   2. ATAS International, Inc; Dutch Seam: www.atas.com/#sle.
   3. Petersen Aluminum Corporation; Snap-Clad Panel: www.pac-clad.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads indicated on structural drawings at support spacing indicated indicated on drawings, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
   2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
   3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.03 METAL ROOF PANELS

A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Aluminum-zinc alloy-coated steel complying with ASTM A792/A792M; minimum AZ50 coating.
      b. Steel Thickness: Minimum 24 gauge, 0.024 inch.
   2. Profile: Standing seam, with minimum 1-1/2 - 2-inch seam height; concealed fastener system lapped seam in standing seam profile.
   3. Texture: Smooth, with intermediate ribs for added stiffness.
   4. Length: Full length of roof slope, without lapped horizontal joints.
   5. Width: Maximum panel coverage of 16 inches.

2.04 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

B. Substrate: Metal panels are to be installed on a pre-manufactured metal building consisting of roof perlins with thermal blocks & batt insulation and wall girts with thermal tape insulation.

2.05 FINISHES

A. Fluoropolymer Coil Coating System: Manufacturer's standard multi-coat metal coil coating system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch; color and gloss to match sample.

2.06 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, trim, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib Closures at Eaves and Ridge Box Trim: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
   1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
   2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
   3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Coordinate roofing and wall panel work with provisions for drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed envelope will be free of leaks.

B. Remove protective film from surface of roof panels immediately prior to installation; strip film carefully to avoid damage to prefinished surfaces.

C. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

3.03 INSTALLATION

A. Overall: Install roof and wall panel system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of metal panel system in place allowing for thermal and structural movement.
   1. Install metal panel system with concealed clips and fasteners.
   2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete metal panel assembly, including flashings, trim, closure strips, preformed crickets, equipment curbs, ridge closures, and similar roof accessory items.

C. Metal Panels: Install metal roof and wall panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.

3.04 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.05 PROTECTION

A. Do not permit storage of materials or foof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect metal panels until completion of project.

B. Touch-up, repair, or replace damaged metal panels or accessories before Date of Substantial Completion.

END OF SECTION 07 4113

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

B. 08 4313 - Aluminum-Framed Storefronts: Storefront system installed in conjuction with metal trim provided as part of this section.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

E. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction 2022.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

G. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).

H. CDA A4050 - Copper in Architecture - Handbook current edition.

I. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch thick base metal, shop pre-coated with PVDF coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
2. Color: As selected by Architect from manufacturer's standard colors.

B. Anodized Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 20 gauge, 0.032 inch thick; clear anodized finish.

C. Copper: ASTM B370, cold rolled 16 oz/sq ft, 24 gauge, 0.0216 inch thick; natural finish.

2.02 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

2.03 EXTERIOR PENETRATION FLASHING PANELS

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.04 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Primer Type: Zinc chromate.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Comply with drawing details.

B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 07 6200

SECTION 07 9200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

B. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).

B. ASTM C834 - Standard Specification for Latex Sealants 2017.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.

F. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.
   5. Substrates for which use of primer is required.
   6. Sample product warranty.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Executed warranty.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints indicated below.
   2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
      a. Joints between door, window, and other frames and adjacent construction.
      b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
      c. Other joints indicated below.
      d. Concrete slab control joints.

B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.
   1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, noncuring.
   2. Lap Joints between Manufactured Metal Panels: Butyl rubber, noncuring.

C. Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
   1. Wall and Ceiling Joints in Nonwet Areas: Acrylic emulsion latex sealant.
   2. Wall and Ceiling Joints in Wet Areas: Nonsag polyurethane sealant for continuous liquid immersion.
   3. Floor Joints in Wet Areas: Nonsag polyurethane non-traffic-grade sealant suitable for continuous liquid immersion.
   4. Joints between Tile in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
   5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
   6. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.

D. Interior Wet Areas: restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.02 JOINT SEALANTS - GENERAL

A. Colors: To match or coordinate with adjacent materials, Architect to verify color selections prio to installation. Provide mockups where requested by Architect.

2.03 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   3. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   4. Color: To be selected by Architect from manufacturer's standard range.
   5. Products:
      a. Dow; DOWSIL 795 Silicone Building Sealant: www.dow.com/#sle.
      b. Sika Corporation; Sikasil WS-295: www.usa.sika.com/#sle.

c. Tremco Commercial Sealants & Waterproofing; Spectrem 2: www.tremcosealants.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

B. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: to be selected by Architect.
2. Products:
a. Dow; Dowsil 786: www.dow.com
b. Sika Corporation; Sikasil GP: www.usa.sika.com/#sle.
c. Tremco Commercial Sealants and Waterproofing; Tremsil200:
d. Substitutions: See Section 01 6000 - Product Requirements.

C. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Products:
a. BASF; MasterSeal NP-1: www.basf.com
b. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
c. Tremco Commercial Sealants & Waterproofing; Vulkem 116: www.tremcosealants.com/#sle.
d. Substitutions: See Section 01 6000 - Product Requirements.

D. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multicomponent; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.

E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.

F. Noncuring Butyl Sealant: Solvent-based, single component, nonsag, nonskinning, nonhardening, nonbleeding; nonvapor permeable; intended for fully concealed applications.

2.04 SELF-LEVELING JOINT SEALANTS

A. Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
1. Durometer Hardness, Type A: 75, minimum, after seven days when tested in accordance with ASTM D2240.
2. Color: To be selected by Architect from manufacturer's standard colors.
3. Joint Width, Minimum: 1/8 inch.
4. Joint Width, Maximum: 1/2 inch.
5. Joint Depth: Provide product suitable for joints from 1/8 inch to 1 inch in depth excluding space for backer rod.
6. Products:
a. ARDEX Engineered Cements; ARDEX Ardifix: www.ardexamericas.com/#sle.
b. Euclid Chemical Company; EUCO QWIKjoint UVR: www.euclidchemical.com/#sle.
c. Nox-Crete Inc; DynaFlex JF-85: www.nox-crete.com/#sle.
d. Polycoat Products; Poly-Caulk 82: www.polycoatusa.com/#sle.
e. Rust-Oleum Corporation; Concrete Saver Flexible Joint Sealant: www.rustoleum.com/#sle.
f. SpecChem, LLC; Rapid Flex CJ: www.specchemllc.com/#sle.
g. Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width, i.e., at low temperature in thermal cycle. Report failures immediately and repair them.

END OF SECTION 07 9200

H. Verify actual locations of wiring connections before electrified door hardware is installed.

I. Examine doors and frames with the hardware installer for compliance with requirements for installation tolerances, labeled fire door assembly, wall and floor construction, and other conditions affecting door performance.

J. Existing door/frame conditions: The GC and all related trades shall review the existing conditions prior to ordering and installing any new hardware. Notify the architect of any exceptions. All existing doors scheduled to be re-worked and re-used shall be reviewed with the Finish Hardware Submittal and templates before the doors are prepped for the new hardware and re-hung in the door opening.

K. The Hardware Installer shall be responsible for installation of all mechanical and electromechanical hardware items specified in the Hardware Sets, at the end of the section, in accordance with the manufacturer's technical installation guidance, and in addition to all applicable code requirements. Electromechanical hardware items include: electrified hinges, power transfers, network locksets, network exit trim, electrified panic devices.

L. The Division 26 Electrical sub-contractor shall make all wiring connections from the electrified hardware to the power source wiring. The Electrical sub-contractor shall install and connect all power supplies to the electrified hardware items. The Electrical sub-contractor shall provide and install all (120VAC) power source wiring as required for the electrified locking and access control hardware, equipment, accessories, and power supplies.

3.2 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units, which cannot be adjusted to operate freely and smoothly as intended for the application made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

D. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

E. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative[s] of the Finish Hardware manufacturer[s], shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items, which have deteriorated or failed due to faulty design, materials or installation of hardware units. Prepare a written report of any current or predictable problems (of substantial nature) in the performance of the hardware and furnish copy to Owners Agent / Representative.

3.3 HARDWARE SETS

Hardware Group No. CT01A

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CONT. HINGE	027XY		628	IVE
1	EA	PANIC HARDWARE	LD-99-EO		626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-400-993R-70-MT-RHO-JYA6 4AA BATTERY	✓	626	SCE
1	EA	YALE PERMANENT CORE	AS REQUIRED			
1	EA	ELECTRIC STRIKE	6112 FSE 12/24 VAC/VDC	✓	630	VON
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 Provides anchorage for 5th screw used w/Cush Arm		689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 Check Frame Details and remove Blade Stop Spacer if Blade Stop is not used		689	LCN
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER			
1	EA	THRESHOLD	566BK-223		BK	ZER
1	EA	POWER SUPPLY	PS902 900-2RS 120/240 VAC Coordinate Power Supply Requirement with Security Provider	✓	LGR	SCE
1	EA	DIAGRAM	ELEVATION			DLR
1	EA	DIAGRAM	POINT TO POINT			DLR

COORDINATE WITH ALL RELATED TRADES.

DOOR LOCKED AT ALL TIMES. UNLOCK BY KEY OVERRIDE OR VALID CREDENTIAL TO READER.
REMOTE RELEASE OF ELECTRIC STRIKE BY AIPHONE AT DESK.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.

Hardware Group No. CT01B

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	027XY	628	IVE
1	EA	PANIC HARDWARE	LD-99-EO	626	VON
1	EA	YALE RIM CYLINDER	AS REQUIRED		
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 Provides anchorage for 5th screw used w/Cush Arm	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 Check Frame Details and remove Blade Stop Spacer if Blade Stop is not used	689	LCN
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	THRESHOLD	566BK-223	BK	ZER

Hardware Group No. CT02

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CYLINDRICAL DEADBOLT	D162	626	YAL
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8302 6" 6" X 16"	630	IVE
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	MOP PLATE	8400 8" X 1" LDW B-CS	630	IVE
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. CT03

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	5405	626	YAL
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	SURFACE CLOSER	4040XP EDA	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. CT04

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	PRIVACY LOCK	5402	626	YAL
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	MOP PLATE	8400 8" X 1" LDW B-CS	630	IVE
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. CT05

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 LOCK	5407	626	YAL
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. CT06

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 LOCK	5407	626	YAL
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	OH STOP	90S	630	GLY
1	EA	SURFACE CLOSER	4040XP REG	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER

Hardware Group No. CT07

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	LD-99-EO	626	VON
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 Provides anchorage for 5th screw used w/Cush Arm	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 Check Frame Details and remove Blade Stop Spacer if Blade Stop is not used	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	THRESHOLD	566BK-223	BK	ZER

Hardware Group No. CT08

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	STOREROOM LOCK	5405	626	YAL
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 Provides anchorage for 5th screw used w/Cush Arm	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 Check Frame Details and remove Blade Stop Spacer if Blade Stop is not used	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	THRESHOLD	566BK-223	BK	ZER

Hardware Group No. CT09

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ENTRY LOCK	5407	626	YAL
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	OH STOP	90S INSTALL ON INACTIVE LEAF	630	GLY
1	EA	SURFACE CLOSER	4040XP SCUSH INSTALL ON ACTIVE LEAF	689	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. CT10

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
2	EA	AUTO FLUSH BOLT	FB41P	630	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	ENTRY LOCK	5407	626	YAL
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH INSTALL ON ACTIVE LEAF	689	LCN
2	EA	KICK PLATE	8400 8" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	488SBK PSA	BK	ZER
1	EA	WEATHERSTRIPPING	8217SBK PSA	BK	ZER

Hardware Group No. CT11

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	LD-99-L-NL-06	626	VON
1	EA	YALE RIM CYLINDER	AS REQUIRED		
1	EA	YALE PERMANENT CORE	AS REQUIRED		
1	EA	SURFACE CLOSER	4040XP SCUSH	689	LCN
1	EA	CUSH SHOE SUPPORT	4040XP-30 Provides anchorage for 5th screw used w/Cush Arm	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 Check Frame Details and remove Blade Stop Spacer if Blade Stop is not used	689	LCN
1	EA	RAIN DRIP	142AA	AA	ZER
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	THRESHOLD	566BK-223	BK	ZER

END OF SECTION 087100

Door#	HwSet#
100A	CT01A
100B	CT01B
101A	CT09
101B	CT11
102A	CT09
102B	CT11
103A	CT10
103B	CT07
103D	CT07
104A	CT05
104B	CT06
105A	CT04
106A	CT03
107A	CT02
108A	CT02
109A	CT08

SECTION 08 8000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers.

B. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.

D. Section 08 3613 - Sectional Doors: Glazed lites in doors.

E. Section 08 4313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).

D. ASTM C1036 - Standard Specification for Flat Glass 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

F. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.

G. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.

H. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.

I. GANA (GM) - GANA Glazing Manual 2022.

J. GANA (SM) - GANA Sealant Manual 2008.

K. GANA (LGRM) - Laminated Glazing Reference Manual 2019.

L. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use 1990 (2016).

M. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.

N. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.

O. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2023.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit one samples 12 by 12 inch in size of glass units.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Pilkington North America Inc: www.pilkington.com/na/#sle.
   4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure:
      a. Positive/Negative Design Pressure: Calculated in accorance with ASCE 7 and as incicated on structural drawing.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:
      a. Water-Resistive Barriers: See Section 07 2500.
   2. To utilize inner pane of multiple pane insulating glass units for continuity of vapor retarder and/or air barrier seal.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   3. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
   4. Patterned Glass Type: ASTM C1036, Type II - Patterned Flat Glass, Quality - Q5, Form 3 - Patterned glass, with color and performance characteristics as indicated.
   5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Pilkington North America Inc: www.pilkington.com/na/#sle.Pilkington North America Inc: www.pilkington.com/na/#sle.
   4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Metal-Edge Spacers: Aluminum, bent and soldered corners.
   4. Spacer Color: Black.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
      b. Color: Black.
   6. Purge interpane space with dry air, hermetically sealed.

C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Exterior Glazing of Construction Trades Building South Side & Renovation Unless noted otherwise.
   2. Space between lites filled with argon.
   3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
      a. Basis of Design Tint: Vitro Solargray.
      b. Basis of Design Coating: Vitro Solarban 70 Solar Control Low-E (passive type), on #2 surface.
   4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
      a. Tint: Clear.
   5. Total Thickness: 1 inch.
   6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
   7. Visible Light Transmittance (VLT): 32 percent, nominal.
   8. Solar Heat Gain Coefficient (SHGC): 0.24, nominal.
   9. Glazing Method: Dry glazing method, gasket glazing.

D. Type IG-2 - Insulating Glass Units: Vision glass, double glazed.

1. Applications: Exterior glazing at Construction Trades Building Section Door.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Basis of Design Tint: Vitro Solargray.
   b. Basis of Design Coating: Vitro Solarban 70 Solar Control Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
5. Total Thickness: 1/2 inch.
6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
7. Visible Light Transmittance (VLT): 32 percent, nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.24, nominal.
9. Glazing Method: Dry glazing method, gasket glazing.

E. Type IG-3 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing at Construction Trades Building Restrooms.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Basis of Design Tint: Vitro Solargray.
   b. Basis of Design Coating: Vitro Solarban 70 Solar Control Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Coating: Acid etched, on #3 surface.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
7. Visible Light Transmittance (VLT): 32 percent, nominal.
8. Solar Heat Gain Coefficient (SHGC): 0.24, nominal.
9. Glazing Method: Dry glazing method, gasket glazing.

F. Type IG-4 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: Exterior glazing on North Side of Construction Trades Building.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Basis of Design Tint: Vitro Optigray.
   b. Basis of Design Coating: Vitro Solarban 70 Solar Control Low-E (passive type), on #2 surface.
4. Metal edge spacer.
5. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
6. Total Thickness: 1 inch.
7. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.24, nominal.
8. Visible Light Transmittance (VLT): 46 percent, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.28, nominal.
10. Glazing Method: Dry glazing method, gasket glazing.

G. Type IG-5 - Insulating Glass Units: Vision glass, double glazed.
1. Applications: New windows on North side of Existing School.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Basis of Design Tint: Vitro Solarbronze.
   b. Basis of Design Coating: Vitro R100 Low-E (passive type), on #2 surface.
4. Metal edge spacer.
5. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
6. Total Thickness: 1 inch.

7. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.29, nominal.
8. Visible Light Transmittance (VLT): 25 percent, nominal.
9. Solar Heat Gain Coefficient (SHGC): 0.18, nominal.
10. Glazing Method: Dry glazing method, gasket glazing.

2.05 GLAZING UNITS

A. Type GL-1 - Monolithic Exterior Vision Glazing:
1. Applications: Interior Vision Glazing unless otherwise indicated.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.
5. Glazing Method: Dry glazing method, gasket glazing.

2.06 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

3.07 SCHEDULES

END OF SECTION 08 8000

SECTION 08 1213
HOLLOW METAL FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal frames for non-hollow metal doors.

B. Fire-rated hollow metal frames for non-hollow metal doors.

C. Interior glazed borrowed lite frames.

1.02 RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Masonry grout fill of hollow metal frames.

B. Section 08 1416 - Flush Wood Doors: Non-hollow metal door for hollow metal frames.

C. Section 08 7100 - Door Hardware: Hardware, silencers, and weatherstripping.

D. Section 08 8000 - Glazing: Glazed borrowed lites.

E. Section 09 9123 - Interior Painting: Field painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2022.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.

G. ASTM A1011/A1011M - 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 2018a.

H. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

J. ITS (DIR) - Directory of Listed Products Current Edition.

K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.

L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.

N. UL (DIR) - Online Certifications Directory Current Edition.

O. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Frames with Integral Casings:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
   3. HMF Express: www.hmfexpress.com
   4. Republic Doors, an Allegion brand; <>: www.republicdoor.com/#sle.
   5. Steelcraft, an Allegion brand; <>: www.allegion.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Refer to Door and Frame Schedule on the drawings for frame sizes, fire ratings, sound ratings, finishing, and other variations.

B. Door Frame Type: Provide hollow metal door frames with integral casings.

C. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.

D. Accessibility: Comply with ICC A117.1 and ADA Standards.

E. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.

F. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior frame that is also indicated as being sound-rated must comply with the requirements specified for exterior frames and for sound-rated frames; where two requirements conflict, comply with the most stringent.

G. Hardware Preparations, Selections and Locations: Comply with BHMA A156.115, NAAMM HMMA 830, NAAMM HMMA 831 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

H. Zinc Coatingfor Units in Wet Locations (Kitchens, Janitor Closets, Restrooms, Shower Rooms): Components zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise.

I. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

J. Frame Head Members: See door frame elevations on drawings for door head member heights.

K. Frames Wider than 48 Inch: Reinforce with steel channel fitted tightly into head of frame, flush with top.

2.03 HOLLOW METAL DOOR FRAMES WITH INTEGRAL CASINGS

A. Frame Finish: Factory primed and field finished.

B. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 3 - Extra Heavy-duty.
      b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
      c. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
      d. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M. See door schedule for locations.

C. Fire-Rated Door Frames: Full profile/continuously welded type.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 3 - Extra Heavy-duty.

b. Physical Performance Level A 1 000 000 cycles; in accordance with ANSI/SDI A250.4.
c. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
d. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M. See door schedule for locations.

2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C or NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by ITS (DIR) or UL (DIR).
   a. Attach fire rating label to each fire rated unit with metal lable rivited to frame.

D. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.04 ACCESSORIES

A. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.

B. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

C. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install frames in accordance with manufacturer's instructions and related requirements of specified frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Comply with glazing installation requirements of Section 08 8000.

F. Install door hardware as specified in Section 08 7100.

G. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edges, crossed corner to corner.

3.05 SCHEDULE - SEE DRAWINGS

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION 08 1213

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS

A. Section 08 1213 - Hollow Metal Frames.

B. Section 08 7100 - Door Hardware.

C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.

C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2021, with Errata (2022).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings and schedules: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
   1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

D. Samples: Submit two samples of door veneer, 2 by 3 inch in size illustrating wood grain, stain color, and sheen.

E. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
   1. Graham Wood Doors; Supreme Door (GSD): www.grahamdoors.com.
   2. Marshfield DoorSystems, Inc; Signature Series: www.marshfielddoors.com.
   3. VT Industries, Inc; Heritage Collection: www.vtindustries.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 DOORS

A. Doors: Refer to drawings for locations and additional requirements.
   1. Quality Level: Custom Grade, Extra Heavy Duty performance, in accordance with WDMA I.S. 1A.
   2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
   1. Provide solid core doors at all locations.

2.03 DOOR AND PANEL CORES

A. All doors: Provide doors with no added urea formaldehyde including, but not limited to, adhesives, cores, cross bands, stiles and rails.

B. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: Red oak, HPVA Grade A, rift cut (only red and white oak), with slip match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer.
   2. "Pair Match" each pair of doors.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.

D. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

E. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

F. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
   1. Transparent:
      a. System - TR-8, UV Cured Acrylated Polyester/Urethane.
      b. Stain: As selected by Architect to match existing doors. If standard range of stain colors does not provide an acceptable color match, custom mix stain to match.
      c. Sheen: Flat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION 08 1416

SECTION 08 3323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior coiling doors.

B. Electric operators and control stations.

C. Wiring from electric circuit disconnect to operators and control stations.

1.02 RELATED REQUIREMENTS

A. Section 26 0533.13 - Conduit for Electrical Systems: Conduit from electric circuit to operator and from operator to control station.

B. Section 26 0583 - Wiring Connections: Power to disconnect.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.

E. ITS (DIR) - Directory of Listed Products Current Edition.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).

H. NEMA MG 1 - Motors and Generators 2021.

I. UL (DIR) - Online Certifications Directory Current Edition.

J. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general construction, electrical equipment, and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Samples: Two slats, 2 by 6 inches in size illustrating shape, color and finish texture.

E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Specimen warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified and indicated.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for roller shaft counterbalance assembly. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Overhead Coiling Doors:
   1. Clopay Building Products; Model CESD20: www.clopaydoor.com/#sle.
   2. Raynor Garage Doors; DuraCoil, Model HIF: www.raynor.com/#sle.
   3. Wayne-Dalton, a Division of Overhead Door Corporation; Model 800: www.wayne-dalton.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COILING DOORS

A. Exterior Coiling Doors: Aluminum slat curtain.
   1. Capable of withstanding positive and negative wind loads of that specified on structural drawings without undue deflection or damage to components.
   2. Sandwich Slats: Manufacturer's standard, with core of foamed-in-place polyurethane insulation; minimum R-value of 7.7.
   3. Nominal Slat Size: 3 inches wide by required length.
   4. Finish: Anodized, clear color.
   5. Guide, Angles: Galvanized steel.
   6. Hood Enclosure: Manufacturer's standard; primed steel.
   7. Electric operation.
   8. Mounting: Surface mounted.
   9. Locking Devices: Slide bolt on inside.

2.03 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Interlocking slats.
   1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
   2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
   3. Double-Wall Aluminum Slats: Minimum thickness; manufacturer's standard for door size and application, made from ASTM B221 (ASTM B221M), aluminum alloy Type 6063.

B. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
   1. Hot-dip galvanized in compliance with ASTM A123/A123M.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
   1. Prime painted.

E. Lock Hardware:
   1. For motor operated units, additional lock or latching mechanisms are not required.
   2. Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.

2.04 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.

1. Provide interlock switches on motor operated units.

B. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Enclosure:
      a. Exterior Coiling Doors: NEMA MG 1, Type 4; open drip proof.
   3. Motor Rating: 3/4 HP; continuous duty.
   4. Motor Voltage: 120 volts, three phase, 60 Hz. Verify with electrical drawings.
   5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   6. Controller Enclosure: NEMA 250, Type 4.
   7. Opening Speed: 12 inches per second.
   8. Brake: Manufacturer's standard type, activated by motor controller.
   9. Manual override in case of power failure.
   10. See Section 26 0583 for electrical connections.

C. Control Station: Provide standard three button, 'Open-Close-Stop' momentary-contact control device for each operator complying with UL 325.
   1. 24 volt circuit.
   2. Surface mounted, at interior door jamb.
   3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
      a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that adjacent construction is suitable for door installation.

B. Verify that electrical services have been installed and are accessible.

C. Verify that door opening is plumb, header is level, and dimensions are correct.

D. Notify Architect of any unacceptable conditions or varying dimensions.

E. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 26 0583.

F. Complete wiring from disconnect to unit components.

G. Install enclosure and perimeter trim.

3.03 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.04 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION 08 3323

SECTION 08 3613
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead sectional doors, electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 08 8000 Glazing:

B. Section 26 0533.13 - Conduit for Electrical Systems: Conduit from electric circuit to operator and from operator to control station.

C. Section 26 0583 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

C. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).

D. DASMA 102 - American National Standard Specifications for Sectional Doors 2018.

E. ITS (DIR) - Directory of Listed Products Current Edition.

F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL (DIR) - Online Certifications Directory Current Edition.

J. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details. Include documentation that door and hardware meet project wind loads.

C. Product Data: Show component construction, anchorage method, and hardware.

D. Samples: Submit two panel finish samples, 2 by 2 inch in size, illustrating color and finish.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Operation Data: Include normal operation, troubleshooting, and adjusting.

H. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by UL (DIR), as suitable for purpose specified.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for electric motor and transmission and delamination of door panels.

D. Provide five year manufacturer warranty for electric operating equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sectional Doors:
   1. Overhead Door; Model 521: www.overheaddoor.com
   2. C.H.I. Overhead Doors; Model 3295: www.chiohd.com/#sle.
   3. Clopay Building Products; 904: www.clopaydoor.com/#sle.
   4. Wayne-Dalton, a Division of Overhead Door Corporation; Model 452: www.wayne-dalton.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ALUMINUM DOORS

A. Aluminum Doors: Stile and rail aluminum with solid and glazed panels; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
   2. Door Nominal Thickness: 1-3/4 inches thick.
   3. Finish: Factory anodized; clear anodized.
   4. Glazed Lights: Full panel width, one row; set in place with resilient glazing channel.
   5. Electric Operation: Electric control station.

B. Door Panels: Paneled aluminum construction; extruded aluminum stiles and rails; 1/2 inch thick infill panels of glass; stile and rail joints welded; rabbeted weather joints at meeting rails.

C. Glazing: Fully tempered glass; insulated glass units; tinted; 1/2 inch overall thickness.

2.03 COMPONENTS

A. Track: Rolled galvanized steel, 0.090 inch minimum thickness; 3 inch wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch thick.

B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.

D. Sill Weatherstripping: Resilient rubber strip, one piece; fitted to bottom of door panel, full length contact.

E. Jamb Weatherstripping: Roll formed aluminum section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

F. Head Weatherstripping: EPDM rubber seal, one piece full length.

G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

C. Float Glass: Provide float glass glazing, unless noted otherwise.
   1. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
      a. Refer to Section 08 8000 Glazing for specific requirements.

2.05 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.

B. Electric Operators:
   1. Mounting: Side mounted on cross head shaft.
   2. Motor Rating: 3/4 hp; continuous duty.
   3. Motor Voltage: 120 volts, three phase, 60 Hz. Verify with electrical drawings.
   4. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   5. Controller Enclosure: NEMA 250, Type 1.
   6. Brake: Adjustable friction clutch type, activated by motor controller.
   7. Manual override in case of power failure.
   8. Refer to Section 26 0583 for electrical connections.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325. Also, provide fire station timer; push button or pull cord activating the open cycle and timer-to-close feature, only the push button or pull cord will control timer-to-close.
   1. 24 volt circuit.
   2. Surface mounted, at interior door jamb.
   3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
      a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

F. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air barrier seal.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

F. Install perimeter trim.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.

B. Maximum Variation from Level: 1/16 inch.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.06 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION 08 3613

SECTION 08 4313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Flashing where storefront abutts masonry.

D. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 07 4213 - Metal Wall Panels: Flashing where storefront abutts metal panels.

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

D. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.

D. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2021a.

E. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, insulated metal infill panels, door hardware, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, fastener types and spacing, expansion and contraction joint location and details, and field welding required.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a ten year period after the Date of Substantial Completion.

C. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer Trifab 451T.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. Trulite Glass and Aluminum Solutions, LLC; CS451: www.trulite.com.
   2. YKK AP America Inc; YES 45 ST: www.ykkap.com/#sle.

C. Substitutions: See Section 01 6000 - Product Requirements.
   1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.02 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Insulating Glazing:
   1. Basis of Design: Kawneer 500T Insulpour Thermal Entrance.
   2. Thickness: 2 1/4 inches.
   3. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
      a. Trulite Glass and Aluminum Solutions, LLC; Magnum Entrances: www.trulite.com.
      b. YKK AP America Inc; 50M Monumental Commercial Entrances: www.ykkap.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.
         1) For any product not identified as "Basis of Design", submit information as specified for substitutions.

B. Flush, aluminum skinned, Thermally-Broken:
   1. Basis of Design: Kawneer Flushline Series, embossed aluminum face sheets..
   2. Thickness: 2-1/4 inches.
   3. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
      a. Trulite Glass and Aluminum Solutions, LLC: www.trulite.com.
      b. YKK AP America Inc: www.ykkap.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.
         1) For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Unitized, shop assembly.
   2. Glazing Rabbet: For 1 inch insulating glazing.
   3. Finish: Class II natural anodized and colored anodized. (

a. Factory finish all surfaces that will be exposed in completed assemblies.
b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Maintain nominal 3/8" clearance between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
a. Positive/Negative Design Wind Loads: See structural drawings for lbf/sf ft.
b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Glazing Stops: Flush.

B. Glazing: As specified in Section 08 8000. 1" insulating glazing at exterior storefront and sw" monolithic glazing at interior storefront.

C. Swing Doors: Flush or with aluminum framed vision lites - See Schedules on drawings..
1. Bottom Rail: Minimum 10 inches high.
2. Glazing Infill:
a. Exterior Doors: 1" Insulating glazing.
3. Glazing Stops: Square.
4. Finish: Same as storefront.

D. Accessories:
1. At perimeter storefront framing, provide plastic/vinyl non-structural flat fillers (Shim backers) to support backer rods.

E. Operable Sash: Aluminum project-out awning; finished to match storefront; turn handle latch with manufacturer's standard insect screen.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209/B209M.

C. Fasteners: Stainless steel.

D. Exposed Flashings: Aluminum sheet, 0.040 inch (1.0 mm) minimum thickness or as indicated on drawings; finish to match framing members.

E. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.

F. Sealant for Setting Thresholds: Non-curing butyl type.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: See Section 08 8000.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

2.07 HARDWARE

A. For each door, include weatherstripping.

B. Other Door Hardware: See Section 08 7100.

C. Weatherstripping: Bulb type, continuous and replaceable; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Coordinate sequence of work with other trades; flashing provided by metal wall panel installer where storefront abutts metal wall panels.

B. Install wall system in accordance with manufacturer's instructions.

C. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

D. Provide alignment attachments and shims to permanently fasten system to building structure.

E. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

F. Provide thermal isolation where components penetrate or disrupt building insulation.

G. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

H. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

J. Install operating sash.

K. Install glass and infill panels in accordance with Section 08 8000, using exterior wet/dry glazing method.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION 08 4313

SECTION 08 6200
UNIT SKYLIGHTS

SECTION INCLUDES

1.01 SKYLIGHTS WITH INTEGRAL FRAME.

1.02 PRE-MANUFACTURED ROOF CURBS

RELATED REQUIREMENTS

3.01 SECTION 07 4113 - METAL ROOF PANELS: ROOFING SYSTEM AND BASE FLASHING AT SKYLIGHT CURB.

REFERENCE STANDARDS

4.01 AAMA/WDMA/CSA 101/I.S.2/A440 - NORTH AMERICAN FENESTRATION STANDARD/SPECIFICATION FOR WINDOWS, DOORS, AND SKYLIGHTS; 2017.

4.02 ASCE 7 - MINIMUM DESIGN LOADS AND ASSOCIATED CRITERIA FOR BUILDINGS AND OTHER STRUCTURES; MOST RECENT EDITION CITED BY REFERRING CODE OR REFERENCE STANDARD.

4.03 ASTM B221 - STANDARD SPECIFICATION FOR ALUMINUM AND ALUMINUM-ALLOY EXTRUDED BARS, RODS, WIRE, PROFILES, AND TUBES; 2014.

4.04 ASTM B221M - STANDARD SPECIFICATION FOR ALUMINUM AND ALUMINUM-ALLOY EXTRUDED BARS, RODS, WIRE, PROFILES, AND TUBES (METRIC); 2013.

4.05 ASTM A792/A792M - STANDARD SPECIFICATION FOR STEEL SHEET, 55% ALUMINUM-ZINC ALLOY-COATED BY THE HOT-DIP PROCESS 2022.

4.06 29 CFR 1910.29 - FALL PROTECTION SYSTEMS AND FALLING OBJECT PROECTION - CRITERIA AND PRACTICES CURRENT EDITION.

SUBMITTALS

5.01 SEE SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS, FOR SUBMITTAL PROCEDURES.

5.02 PRODUCT DATA: PROVIDE STRUCTURAL, THERMAL, AND DAYLIGHTING PERFORMANCE VALUES.

WARRANTY

6.01 SEE SECTION 01 7800 - CLOSEOUT SUBMITTALS, FOR ADDITIONAL WARRANTY REQUIREMENTS.

6.02 PROVIDE FIVE YEAR MANUFACTURER WARRANTY, INCLUDING COVERAGE FOR LEAKAGE DUE TO DEFECTIVE SKYLIGHT MATERIALS OR CONSTRUCTION.

PART 2 PRODUCTS

SKYLIGHTS

9.01 SKYLIGHTS: FACTORY-ASSEMBLED GLAZING IN ALUMINUM FRAME, FREE OF VISUAL DISTORTION, AND WEATHERTIGHT.

A. Basis of design: Velux CEC3 curb-mounted plastic unit skylight, standard triple dome configuration. See Section 01 6000 for substitution requirements.

B. Shape: Square dome.

C. Glazing: Triple.

D. Operation: None; fixed.

E. Roof Slope: As indicated on drawings.

F. Nominal Size: 22 by 22 inch.

PERFORMANCE REQUIREMENTS

10.01 PROVIDE UNIT SKYLIGHTS THAT COMPLY WITH THE FOLLOWING:

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific skylight type:
   1. Performance Grade (PG): To meet loads as required by structural drawings.

B. U-Factor: 0.60 maximum.

C. SHGC: 0.35 maximum.

D. Allow for expansion and contraction within system components caused by a cycling surface temperature range of 170 degrees F (95 degrees C) without causing detrimental effects to system or components.

COMPONENTS

11.01 TRIPLE GLAZING: POLYCARBONATE PLASTIC OR IMPACT-MODIFIED ACRYLIC; FACTORY SEALED.

A. Outer Glazing: White translucent.

B. Middle Glazing: Clear transparent.

C. Inner Glazing: White translucent.

11.02 FRAMES: ASTM B221 (ASTM B221M) EXTRUDED ALUMINUM REINFORCED CORNER JOINTS, INTEGRAL CURB FRAME MOUNTING FLANGE TO RECEIVE ROOFING FLASHING SYSTEM, GLAZING RETAINER; BRONZE ANODIZED FINISH.

ACCESSORIES

12.01 ROOF CURBS FOR UNIT SKYLIGHTS.

A. Roof Curbs with Integrated Fall Protection
   1. Roof curbs shall be provided by the same manufacturer as unit skylights. See Sectioin 01 6000 for subsitution requirements.
   2. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
      a. Roof Curb Mounting Substrate: Curb substrate consists of pre-engineered metal building roof purlin system and standing seam metal roof panels, curbs to be flashed into standing seam roofing. See Section 07 4113 for metal flashing requirements.
      b. Sheet Metal Material:
         1) Galvalume Steel: Hot-dip aluminum zinc alloy coated steel sheet complying with ASTM A792/A792M; AZ55 coating designation; 18 gauge, 0.048 inch thick.
      c. Safety Security Mesh:
         1) Curb shall include internal wire mesh safety security guard complying with OSHA 1910.29 and 1926.502.
      d. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
         1) Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch clearance between curb and metal roof panel flange allowing water to properly flow past curb.
         2) Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
         3) Maintain at least 12 inch clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
         4) Lap lower curb flange overtop of down sloping metal roof panel and seal connection.
      e. Provide layouts and configurations indicated on drawings.

12.02 ANCHORAGE DEVICES: STAINLESS STEEL, TYPE RECOMMENDED BY MANUFACTURER, EXPOSED TO VIEW.

12.03 SEALANT: ELASTOMERIC, SILICONE OR POLYURETHANE, COMPATIBLE WITH MATERIAL BEING SEALED .

PART 3 EXECUTION

13.01 EXAMINATION

13.02 VERIFY EXISTING CONDITIONS BEFORE STARTING WORK.

13.03 VERIFY THAT OPENINGS AND SUBSTRATE CONDITIONS ARE READY TO RECEIVE WORK OF THIS SECTION.

13.04 VERIFY THAT CURBS AND ROOF FLASHINGS INSTALLED UNDER OTHER SECTIONS ARE COMPLETE.

INSTALLATION

15.01 INSTALL SKYLIGHT UNITS AND MOUNT SECURELY TO CURB ASSEMBLY; INSTALL COUNTERFLASHING AS REQUIRED.

15.02 APPLY SEALANT TO ACHIEVE WATERTIGHT ASSEMBLY.

15.03 INSTALL ROOF CURBS IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS, IN MANNER THAT MAINTAINS ROOFING SYSTEM WEATHER-TIGHT INTEGRITY.

CLEANING

16.01 REMOVE PROTECTIVE MATERIAL FROM PREFINISHED ALUMINUM SURFACES.

16.02 WASH DOWN EXPOSED SURFACES; WIPE SURFACES CLEAN.

16.03 REMOVE EXCESS SEALANT.

END OF SECTION 08 6200

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Work under this section includes furnishing and the installation of finish hardware specified herein and noted on drawings for a complete and operational system, including any electrified door hardware components and low-speed auto operators.

B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Definition: "Finish Hardware" includes items known commercially as finish / security hardware and systems which are required for swing, sliding and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

B. Extent of finish / security hardware required is indicated on drawings and in Part 3: Hardware Sets. Provide items, articles, materials, operations and methods listed, mentioned or scheduled herein or on the drawings, in quantities as required to complete the project. Provide hardware that functions properly and compliant with required Codes: Fire/Life Safety/ADA. Prior to furnishing the hardware, advise the architect of items that will not operate properly, are improper for conditions, or will not remain permanently anchored.

C. Types of finish hardware required include, but are not limited to, the following:

1. Butt Hinges
2. Continuous Hinges
3. Lock cylinders and keys
4. Lock and latch sets
5. Exit devices
6. Door Pulls
7. Closers
8. Door trim units
9. Weatherstripping for exterior doors
10. Protection plates
11. Thresholds, Gaskets, and Door Bottoms
12. Key Cabinet
13. Electrified Hardware
14. Coat Hooks at office doors

D. References

1. NFPA-80- as adopted - Standard for Fire Doors and Windows
2. NFPA-101-as adopted - Life Safety Code
3. NFPA - 70 - National Electric Code
4. ADA - The Americans with Disabilities Act - Title III - Public Accommodations
5. ANSI-A 117.1-American National Standards Institute - Accessible and Usable Buildings and Facilities
6. ANSI-A156.5-American National Standards Institute - Auxiliary Locks and Associated Products
7. NC Building Code as Adopted.
8. Positive Pressure Testing UL10C & UBC7.2
9. UL - Underwriters Laboratories
10. WHI - Warnock Hersey International, Division of Intertek Testing Services
11. State, Local and Federal Codes, National Electrical Building Codes, including the Authority Having Jurisdiction.

1.3 QUALITY ASSURANCE

A. Manufacturer: Obtain each type of hardware (ie., lock sets / security equipment) from a single manufacturer, although several may be indicated as offering products complying with requirements.

B. Supplier: A recognized architectural finish hardware supplier, with warehousing facilities, who has been furnishing hardware and installation in the project's vicinity for a period of not less than 5 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 project's hardware requirements, to the Owner, Architect and the Contractor. The architectural hardware consultant (AHC) shall prepare all hardware and wiring diagrams. This Supplier is responsible for proper coordination of all finished hardware with related sections to insure compatibility of products. The Hardware Supplier shall attend all coordination meetings regarding hardware applications with related trades.

C. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Standard No. 80 and local building code requirements. Provide only hardware, which has been tested and listed by UL / WHI or FM for types and sizes of doors required and complies with requirements of door and door frame labels. Provide door seals to meet Positive Pressure Testing UL10C and UBC7 - 2 as required.

D. Where emergency exit devices are required on fire-rated doors (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL / WHI or FM label on exit devices indicating "Fire Exit Hardware".

E. Thru bolt door closers at all doors and exit devices – except at FRP doors. The Hardware Supplier shall verify and coordinate proper blocking if provided from the door manufacturer for hardware attachment on doors.

F. Unless otherwise specified, provide lever handle locksets ADA compliant.

G. Pre-Installation Meeting: The GC /CM shall initiate and conduct a jobsite meeting with the hardware supplier and the Installer, and all related trades for mechanical and electrical hardware. This meeting shall convene at least one month prior to commencement of the related work, specifically, the electrical rough-in for coordination of electrified hardware applications. All approved shop drawings, wiring diagrams, and schedules shall be made available to all related trades as required for work to be performed. The Owner's representative shall attend all pre-install meetings. One month prior to the installation of the hardware, the hardware supplier shall, with the assistance of the manufacturer's representative, provide review/training to the Installers of the following products: closers, exit devices, locks, and electrified hardware.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each item of hardware in accordance with Division-1 section "Submittals". Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and finish.

B. Hardware Schedule: Submit copies of the schedule in accordance with Division 1 - “Submittals”, General Requirements. Schedule shall be in vertical format, listing each door opening, including: handing, all hardware scheduled for the opening or otherwise required to allow for proper function of door openings as intended, and the finish of the hardware. At doors with door closers or door controls, include degree of door opening. If requested, all submittals (schedules, cut sheets, diagrams) shall be reviewed by the Owner’s representative prior to ordering the material. Furnish wiring diagrams for all electrified hardware.

1. Final Hardware Schedule Content: Based on finish hardware indicated, organize hardware schedule into a vertical format with "hardware sets" indicating complete designations of every item required for each door or opening. Include the following information:

a. Type, style, function, size and finish of each hardware item.
b. Name and manufacturer of each item.
c. Fastenings and other pertinent information.
d. Maintain the same Set/Heading numbering from Part 3 of this section, or reference to the

Spec Set number in the Heading.

e. Reference door numbers from the door/frame schedule in the plan set.
f. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
g. Mounting locations for hardware.
h. Door and frame sizes and materials.
i. Keying information as available.
j. One Heading/Set per page
k. Operational Description for all specified electrical hardware shall be included with each Heading/Set.

C. Submittal Sequence: Submit hardware schedule and wiring diagrams according to the GC's established project schedule, particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames), and electrical rough-in, which is critical in the project construction schedule. Include with schedule the product data, catalog cuts, samples, templates, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.

D. Keying Schedule: Coordinate, and prepare as required, the keying schedule after meeting with the Owner to determine the Owner's instructions for keying.

E. Samples if Requested: Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit any requested samples of type of exposed hardware unit, finished as required, and tagged with full description for coordination with schedule.

F. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location, coordination and installation of hardware.

G. Manufacturer's Catalog Cuts: Submit manufacturer's cut/catalog sheets on all hardware items and any required special mounting instructions with the hardware schedule.

H. Wiring Diagrams: Provide complete wiring diagrams for each opening requiring electrified hardware. Provide an elevation drawing, with each electrified hardware set. Provide a point-to-point diagram prior to the delivery of hardware to job site and another copy to the Owner at time of job completion. All electrical components shall be listed by opening in the hardware submittals. Include an operational description with each diagram.

I. Operational Descriptions: Provide a complete operational description of the specified electrified hardware components for each opening, and include the description under the hardware set/heading in the hardware submittal. Operational descriptions shall detail how each electrified component functions within the opening, incorporating all conditions of ingress and egress. Review these descriptions with all related trades at the Pre-Install meetings.

J. Elevation Drawings: Provide elevation drawings of electronic hardware and systems identifying locations of the system components with respect to their placement in the door opening. Include the number of wires, with the gauge included, needed at the specific locations. Provide a copy with each hardware schedule submitted for approval. Supply another copy to the Owner upon project completion. Include an operational description with each drawing.

1.5 PRODUCT 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. Inventory hardware jointly with the General Contractor, representatives of hardware supplier / hardware installer until each is satisfied that count is correct.

C. Deliver individually packaged hardware items at the proper times to the proper locations (shop r project site) for installation.

D. The General Contractor shall provide secure lock-up for hardware and security equipment delivered to the project, but not yet installed. Control handling and installation of hardware items, which are not immediately replaceable, so that completion of the work will not be delayed by hardware losses, both before and after installation.

1.6 SEQUENCING AND SCHEDULING

A. Deliver all finish hardware to the job site in a timely manner so not to delay progress of other trades.

1.7 WARRANTY

A. Door closers shall include a thirty (30) year manufacturers' warranty against defects in materials and workmanship.

B. Exit Devices shall include a three (3) year warranty.

C. Hinges: Life of Building.

D. Electrified Hardware shall include a one (1) year warranty.

E. Other Hardware shall include a three (3) year warranty.

PART 2 - PRODUCTS

2.1 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size and other distinctive qualities of each type of finish hardware are indicated in the Finish Hardware Data Sheet and Hardware Schedule at the end of this section. Products are identified by using hardware designation numbers of the following:

B. Manufacturers:

	Hardware Item:	Specified Manufacturer	Designation
1.	Butt Hinges:	Ives	IVE
2.	Continuous Hinges	Ives	IVE
3.	Locksets:	Yale	YAL
4.	Cylinders/Cores	Yale	YAL
5.	Silencers:	Ives	IVE
6.	Stops:	Ives	IVE
7.	Overhead Stops	Glynn-Johnson	GLY
8.	Closers:	LCN	LCN
9.	Thresholds:	Zero	ZER
10.	Gasket/Door Bottoms:	Zero	ZER
11.	Kickplates:	Ives	IVE
12.	Pull/Push Plates:	Ives	IVE
13.	Exit Devices:	Von Duprin	VON
14.	Flush Bolts:	Ives	IVE
15.	Automatic Flush Bolts:	Ives	IVE
16.	Miscellaneous Hardware:	Ives, Glynn-Johnson	IVE/GLY
17.	Key Cabinet	See Spec	
18.	Network Locksets	Schlage Electronics	SCE
19.	Power Supplies Power Transfers	Von Duprin	VON

C. Provide products as hereafter specified. Substitutions other than those manufacturers listed, must be approved, in writing, via addenda, prior to bid. Procedure for substitutions shall be as outlined in Division 1. No substitutions will be considered after award of contract.

2.2 MATERIALS AND FABRICATION

A. General:

1. Hand of Door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
2. Coordinate door pulls with cylinder lock location to confirm pulls do not interfere with access to lock. Provide offset pulls if required.
3. Manufacturer's Name Plate: Do not use manufacturer's products which have manufacturer's name or trade name displayed in a visible location (omit removable nameplates), except in conjunction with required UL labels and as otherwise acceptable to Architect.
4. Manufacturer's identification will be permitted on rim of lock cylinders only.
5. Finishes:

    a. 626/652 for all finished metal hardware items except as 630 is otherwise indicated. Door closers to be powder coated to match 652/626. Exit devices shall be US26D with stainless steel touchbars.

6. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware, which has been prepared for self-tapping sheet metal screws, except, as specifically indicated.
7. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as possible, including "prepared for paint" in surfaces to receive painted finish.
8. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Use thru-bolts for closer and exit devices. Coordinate wood door blocking at all wood doors and all fire-rated wood doors. Provide sleeves for each thru-bolt or use sex screw fasteners.
9. Tools and Maintenance Instructions for Maintenance: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.3 HINGES AND BUTTS

A. Templates: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

B. Screws: Furnish Phillips flat-head or machine screws for installation of units, except furnish Phillips flat-head or wood screws for installation of units into wood. Finish screw heads to match surface of hinges or pivots.

C. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

1. Steel Hinges: Steel pins.
2. Non-ferrous Hinges: Stainless steel pins.
3. Exterior Doors: Non-removable pins.
4. Out-swing Corridor Doors: Non-removable pins.
5. Interior Doors: Non-rising pins.
6. Tips: Flat button and matching plug, finished to match leaves.
7. Number of hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.
8. **Owner Preferred:**

    a. Ives: 5BB1/5BB1HW

9. Acceptable Manufacturers:

    b. McKinney: TB2714/TB2314/TB3786/TB3386
    c. Stanley: FBB179/199/168/191

D. Continuous Hinges: Provide concealed, non-handed, full height hinges with interlocking cover and symmetrically template hole pattern made from extruded aluminum. Finish shall be BHMA 628. Field modifications for cutting shall be permitted up to 6” from the bottom.

1. Owner Preferred

a. Ives: 112XY

2. Acceptable Manufacturers:

b. Select: SL11HD
c. Stanley: 661HD

2.4 CYLINDERS AND KEYING

A. General: The Hardware Supplier shall furnish the keyed permanent cores and keys for the project. All locks/cylinders shall be furnished with keyed temporary construction cores. The construction cores shall utilize a color-coded construction cores system which is not part of the Owner’s existing permanent key system. The Hardware Supplier shall be responsible for furnishing/invoicing the GC for the construction cores. The General Contractor, under the supervision of the Owner, shall install permanent cores and return the construction cores to the Hardware Supplier for credit to the GC. The Owner shall assume no responsibility for construction cores, and the construction cores shall not be part of the Owner’s material list from the GC. All permanent keyed cores shall be furnished as Yale. Provide permanent keys and cores stamped with the applicable key mark for identifications. These visual key control marks or codes shall not include the actual key cuts: VKC.

B. The NHCS existing key system is a Yale restricted (patented) grandmaster system which shall be utilized for all project keying requirements. Equip locks and cylinders with Yale factory-keyed cores as specified. All cylinder housings shall accept Yale keyed permanent cores. The Hardware Supplier shall confirm all keying and core requirements with the Owner’s representative prior to ordering the cores.

C. Provide permanent keys and cores stamped with the applicable key mark for identifications. These visual key control marks or codes shall not include the actual key cuts: VKC. All cylinders/locksets shall be furnished with temporary construction keyed cores for the construction period of the project. Furnish five (5) Construction Keys and one (1) control key for the General Contractor's use during project construction. Furnish five (5) each Grandmaster keys. Furnish five (5) each Master keys (per master group). Furnish a total of three (3) change keys per cylinder or keyed alike group. Actual cut keys to be determined by the school district. All keys shall be stamped with key symbols and “Do Not Duplicate”.

D. DO NOT provide any permanent control keys.

E. Provide one (1) each bitting list to the Owner by registered mail.

F. Owner Preferred:

1. Yale

2.5 CYLINDRICAL LOCKS

A. Locksets shall be as specified: Cylindrical lockset shall be Series 5400, Grade 1 Operational and Security, UL Listed for 3-hour fire door. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with ANSI curved lip extended to protect frame, finished to match hardware set. Lever rotation shall be in both directions for ease of use and allow for independent lever rotation. All locks except Yale shall be furnished as “less cylinder”. Add Yale cylinders with keyed permanent cores.

B. Lock Throw: Provide solid stainless steel 1-1/2" deadbolt with 1" minimum throw. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

C. Provide 3/4" minimum throw on latch bolts.

D. Owner Preferred:

1. Yale 5400 Series x match existing facility lever

E. Acceptable Manufacturers:

1. Schlage ND Series
2. Corbin-Russwin CL3300 Series

2.6 PULLS/ PUSH PLATES

A. Exposed Fasteners: Provide manufacturer's standard exposed fasteners for installation; through-bolted for matched pairs, but not for single units. Furnish type and size as specified in Hardware Sets.

B. Acceptable Manufacturers:

1. Ives
2. Burns
3. Trimco

2.7 CLOSERS AND DOOR CONTROL DEVICES

A. Size of Units: Except as otherwise specifically indicated, comply with the manufacturer's recommendations for size of door control unit, depending upon size of door, exposure to weather and anticipated frequency of use.

B. Closers: All door closers shall be of one manufacturer to provide for proper installation and servicing after installation. All closers shall use high strength cast iron cylinders, forged main arms, and one-piece forged steel pistons. All closers shall be inspected after installation by a factory representative to ensure proper adjustment and operation. A report shall be filed with the architect after said visit has been made. Closer shall carry a manufacturer's minimum 20-year warranty for hydraulic units and 2-year warranty for electrical and/or handicap power assist door closers against manufacturing defects and workmanship. PRV [pressure relief valves] are not acceptable.

C. Parallel Arm Closers: Shall incorporate one piece solid forged steel arms steel stud shoulder bolts, shall be incorporated in regular arms, hold open arms, arms with stop built in, arms with hold open and stop built in. All other closers to have forged steel main arms for strength, and durability. Unless otherwise specified, mount all closers parallel arm.

D. Built-In Stops: Where closers with built-in positive stops are used, the stops shall be of one piece cast malleable iron material with built in springs. Where required, the hold-open assembly handle for these stops shall rotate on ball bearings.

E. All door closers shall pass UL10C positive pressure fire test.

F. Provide closers with adjustable spring power. Size closers to ensure exterior and fire rated doors will consistently close and latch. Size all other door closer to allow for reduced opening force not to exceed 5 lbs.

G. Hydraulic Fluid: All closers, with the exception of interior electronic closers, shall utilize temperature stable fluid capable of withstanding temperature ranges of 120 degrees F. to -30F. without requiring seasonal adjustment of closer speed to properly close the door. Fluid shall be nonflammable.

H. All closers shall have a powder coat finish on closer body, arm, cover and adapter plate. Furnish special rust inhibiting pretreat coating, as specified, for closer body, arm, cover and plates before the powder coat finish.

I. All door closers shall have full covers and separate adjusting valves for sweep, latch and back-check. Provide all drop plates, shoe supports, templates, etc. to properly mount closers according to manufacturers' recommendations.

J. Owner Preferred:

1. LCN 4040XP/4040XP SCUSH

K. Acceptable Manufacturers:

1. Corbin-Russwin DC8200 A11
2. Sargent 281 x EDA/ 281CS

L. Through bolts shall be used for attachment of closers at all doors.

2.8 EXIT DEVICES

A. General: All devices shall be of one manufacturer to provide for proper installation and servicing. Devices shall be furnished non-handed and capable of direct field conversion for all available trim functions. All devices shall carry a minimum three-year warranty against manufacturing defects and workmanship. All devices shall be push-through touch pad design as specified. No exposed touch bar fasteners, no exposed cavities when operated.

B. Furnish all touch-pad type devices with stainless steel touch bars. Plastic parts are not acceptable. Dogging mechanism shall be mechanical hook type with no plastic dogging cams.

C. Furnish all touch-pad type exit devices with deadlocking latch bolts. Latchbolts shall be moly-coated to reduce friction against the strike.

D. Furnish all touch-pad exit devices with flush end caps. End caps shall be flush with device housing with no raised edges.

E. Furnish roller strikes with all rim exit devices.

F. All removable mullions shall be furnished with key function for removal. Furnish stabilizers similar to Von Duprin 154 with all removable mullions.

G. Outside Trim: Shall be heavy duty type and fastened by means of concealed welded lugs and thru-bolts from the inside. Trim shall be forged brass with a minimum average thickness on the escutcheon of .130. Plate with trim shall be brass with minimum average thickness of .090 and have forged pulls. Where Lever Handles are specified provide 996 type Break Away Trim. Where outside trim is specified, furnish trim that thru-bolts directly to the exit device center case.

H. Furnish cylinders with all lockable exit devices.

I. Furnish required filler plates and shim kits for flush mounting of exit devices on all doors requiring same. Exit devices to be mounted on full-glass doors, shall not have exposed fasteners on the mechanism case.

J. Springs: Compression type only. Torsion springs are not acceptable.

K. Electrified Functions: Electric Latch Retraction shall be provided with a continuous duty solenoid, retracting the latch bolt for momentary latch retraction, or may be held retracted for extended periods of time. Electric operated trim device shall be furnished as Fail-Safe. When the power is off, the trim is unlocked for free entry. The trim may then be relocked electrically by applying power.

L. Exit Device Dogging: Except on fire-rated doors, wherever closers are provided on doors equipped with exit devices, equip the units with keyed dogging device to hold the push bar down and the latch bolt in the open position, or as Less Dogging (LD) as specified.

M. Owner Preferred:

1. Von Duprin 99 Series, 996 Series lever trim, 990 Series pull trim

N. Acceptable Manufacturers:

1. Precision 2100 series, 4900 series lever trim, 1700A series pull trim
2. Sargent 80 series, 700 ET series lever trim, 800 MAL pull trim

2.9 DOOR TRIM UNITS

A. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units (kick plates, edge trim, viewers, knockers, mail drops and similar units); either machine screws or self-tapping screws.

B. Fabricate edge trim of stainless steel, not more than 1/2" nor less than 1/16" smaller in length than door dimension.

C. Fabricate protection plates (armor, kick or mop) not more than 2” less than door width on stop side and not more than 1” less than door width on pull side, x the height indicated.

D. Metal Plates: Stainless steel, .050" (U.S. 18 ga), bevel 3 edges: top and both sides.

E. Acceptable Manufacturers:

1. Ives
2. Trimco
3. Burns

2.10 GASKETS, DOOR BOTTOMS

A. General: Except as otherwise indicated, provide continuous weatherstripping at each edge of every exterior door leaf, except where stated the door manufacturer will provide the weatherstripping. Provide type, sizes and profiles shown or scheduled. Provide non-corrosive fasteners as recommended by manufacturer for application indicated. All gaskets for fire label doors shall comply the door manufacturers label approvals. Fire-label wood doors shall be furnished as “Category A” type with the intumescent seal, integral to the door construction.

B. Sound seal: Provide types as indicated for sound isolation. As indicated in the Door Schedule each door shall receive an automatic door bottom and double row of bulb-type adhesive gasket.

C. Acceptable Manufacturers:

1. National Guard 5050
2. Reese F-797B
3. Zero 188S

2.11 THRESHOLDS

A. General: Except as otherwise indicated provide standard aluminum threshold unit of type, size and profile as shown or scheduled.

B. Provide thresholds that are 1” wider than depth of frame.

C. Provide gasketed threshold for all exterior doors.

D. The hardware supplier shall verify all sill conditions and finish floor conditions and coordinate proper threshold as required to insure a smooth transition between threshold and the interior floor.

E. Acceptable Manufacturers:

SECTION 09 0561
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound.

G. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Additional requirements relating to testing agencies and testing.

B. Section 03 3000 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens) 2021.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete 2020.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.

E. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings 2011.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.

6. Submit report to Architect.
7. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. Copy of RFCI (RWP).

F. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
   3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   4. Manufacturer's installation instructions.
   5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
3. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: As required for application and in accordance with manufacturer's installation instructions.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
      a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
      b. Removal of existing floor covering.
   2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
      a. Do not attempt to remove coating or penetrating material.
      b. Do not abrade surface.
   3. Preliminary cleaning.
   4. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
   5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   7. Specified remediation, if required.
   8. Patching, smoothing, and leveling, as required.
   9. Other preparation specified.
   10. Adhesive bond and compatibility test.
   11. Protection.

B. Remediations:
   1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
   2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
   3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.04 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.05 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.06 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

END OF SECTION 09 0561

SECTION 09 2116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Acoustic insulation.

C. Coated glass mat backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 2100 - Thermal Insulation: Acoustic insulation.

B. Section 09 3000 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members 2016, with Supplement (2020).

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing 2020.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing 2015, with Errata (2020).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

E. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.

F. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).

G. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

H. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.

I. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.

J. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.

K. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel 2018.

L. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.

M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.

N. GA-216 - Application and Finishing of Gypsum Panel Products 2021.

O. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
   2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 7419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

C. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

B. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf. At walls to recieve wall tile provide minimum 20ga studs.
   1. Studs: "C" shaped with flat or formed webs.
   2. Runners: U shaped, sized to match studs.
   3. Furring Members: Hat-shaped sections, minimum depth of 1-1/2 inch.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
   4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.

2.02 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation; <>: www.certainteed.com.
   2. National Gypsum Company; <>: www.nationalgypsum.com.
   3. PABCO Gypsum; <>: www.pabcogypsum.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required at all locations.
   3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch.
      b. Ceilings: 5/8 inch.
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

C. Noise-Reducing Gypsum Wallboard:
   1. Application: Use for vertical surfaces as indicated on drawings.
   2. Products:

a. CertainTeed Corporation; SilentFX QuickCut Type X.
b. National Gypsum Company; GoldBond Soundbreak XP.
c. Pabco Gypsum; Quietrock EZ-Snap MR.
d. Substitutions: See Section 01 6000 - Product Requirements.

3. Thickness:
   a. 5/8 inch.

D. Backing Board For Tile:
1. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
   a. Regular Type: Thickness 5/8 inch.

2.03 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness to match depth of stud.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Finishing Accessories: ASTM C1047, rigid plastic, unless noted otherwise.
1. Types: As detailed or required for finished appearance.
2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead and L-bead at exposed panel edges.

D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

E. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

B. Prior to hanging gypsum board, gypsum board installer shall provide written acceptance of stud installation.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with AISI S220 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center.
1. Extend partition framing as indicated on drawings.
2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

C. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

D. Blocking: Install mechanically fastened steel channel blocking for support of:
1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet accessories.
5. Wall-mounted door hardware.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Place one bead continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board parallel to framing, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.
   2. Install boards such that the bottoms do not rest directly on concrete floor slab, but are not more than 3/8" above the slab.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing. See Section 07 8400 - Firestopping.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as directed by Architect for visual effect.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings in Hall 100 of the Construction Trades Building.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.08 PROTECTION

A. Protect installed surfaces from damage until final completion.

END OF SECTION 09 2116

SECTION 09 3000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for wall applications.

B. Coated glass mat backer board as tile substrate.

C. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 2116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.

D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).

E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship 2019.

F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.

G. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.

H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).

I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).

J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).

K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.

L. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.

M. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).

N. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).

O. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar 2020.

P. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs 2020.

Q. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2019.

R. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation 2019.

S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2022.

T. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products 2018 (Reapproved 2023).

U. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Provide manufacturers' data sheets on tile, mortars, grout, and accessories. Include instruction for using grouts.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 square feet of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

A. Maintain one copy of ANSI A108/A118/A136 and TCNA (HB) on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. American Olean Corporation: www.americanolean.com/#sle.
   2. Dal-Tile Corporation: www.daltile.com/#sle.
   3. Emser Tile, LLC: www.emser.com/#sle.
   4. Florida Tile: www.floridatile.com
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Glazed Wall Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
   2. Size: 6 by 18 inch, nominal.
   3. Surface Finish: Mix of Matte glaze and high gloss.
   4. Color(s): To be selected by Architect from manufacturer's standard range.
   5. Products:
      a. Basis of Design: Dal-Tile Corporation; Linear Color Wheel Collection - Glazed Ceramic: www.daltile.com/#sle.

2.02 TRIM AND ACCESSORIES

A. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Wall corners, outside and inside.
      c. Borders and other trim as indicated on drawings.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com/#sle.
      b. Genesis APS International: www.genesis-aps.com/#sle.
      c. Dural USA, Inc: www.dural.com
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
   2. Products:
      a. ARDEX Engineered Cements; ARDEX X 5: www.ardexamericas.com/#sle.
      b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
      c. H.B. Fuller Construction Products, Inc; TEC TotalFlex 110 Universal Mortar: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc; 257 TITANIUM: www.laticrete.com/#sle.
      e. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com/#sle.
      f. Substitutions: See Section 01 6000 - Product Requirements.

2.04 GROUTS

A. High Performance Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.
   4. Products:
      a. ARDEX Engineered Cements; ARDEX FL: www.ardexamericas.com/#sle.
      b. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com/#sle.
      c. H.B. Fuller Construction Products, Inc; TEC AccuColor Plus Grout: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc; LATICRETE PERMACOLOR Grout: www.laticrete.com/#sle.
      e. Merkrete, by Parex USA, Inc; Merkrete Pro Grout: www.merkrete.com/#sle.
      f. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align wall joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles square.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - WALL TILE

A. Over coated glass mat backer board on studs, install in accordance with TCNA (HB) Method W245.

3.05 CLEANING

A. Clean tile and grout surfaces.

3.06 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION 09 3000

SECTION 09 5100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

B. Section 23 3700 - Air Outlets and Inlets: Air diffusion devices in ceiling.

C. Section 26 5100 - Interior Lighting: Light fixtures in ceiling system.

D. Section 28 4600 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 60 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. USG Corporation: www.usg.com/ceilings/#sle.

B. Suspension Systems:
   1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels, Type 1: Mineral fiber with membrane-faced overlay, with the following characteristics:

1. Application(s): Typical Acoustical Panels, Unless Noted Otherwise.
2. Classification: ASTM E1264 Type IV.
   a. Form: 2, water felted.
   b. Pattern: "E" - lightly textured.
3. Size: 24 by 24 inches.
4. Thickness: 3/4 inch.
5. Light Reflectance: 88 percent minimum, determined in accordance with ASTM E1264.
6. NRC Range: 0.75 to 0..80, determined in accordance with ASTM E1264.
7. Panel Edge: Reveal.
8. Color: White.
9. Suspension System Type 1: Exposed grid.
10. Products:
    a. Armstrong World Industries, Inc; Ultima Beveled Tegular 1911: www.armstrongceilings.com/#sle.
    b. Certainteed; Symphony m 1222BB-75-1: www.certainteed.com.
    c. USG Corporation; Mars SLT 86785: www.usg.com/ceilings/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

C. Acoustical Panels, Type 2: Mineral fiber with membrane-faced overlay, with the following characteristics:
1. Application(s): Kitchen.
2. Classification: ASTM E1264 Type IV.
   a. Form: 1, nodular.
   b. Pattern: "E" - lightly textured.
3. Size: 24 by 24 inches.
4. Thickness: 5/8 inches.
5. Light Reflectance: 85-90 percent minimum, determined in accordance with ASTM E1264.
6. Ceiling Attenuation Class (CAC): 30-35, determined in accordance with ASTM E1264.
7. Panel Edge: Square.
8. Color: White.
9. Suspension System Type 2: Exposed grid.
10. Products:
    a. Armstrong World Industries, Inc; Kitchen Zone-Sustain: www.armstrongceilings.com.
    b. Certainteed; Symphony m 70 Rx: www.certainteed.com.
    c. USG CorporationKitchen Lay-in Panel Climaplus Performance : www.usg.com/ceilings/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, stabilizer bars, clips, and splices as required.

B. Exposed Suspension System, Type 1: Hot-dipped galvanized steel grid.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
2. Profile: Tee; 15/16 inch face width.
3. Finish: Baked enamel.
4. Color: White.
5. Products:
   a. Armstrong World Industries, Inc; Prelude 15/16 inch: www.armstrongceilings.com.
   b. Certainteed; 15/16" EZ Stab Classic System : www.certainteed.com.
   c. USG Corporation; Donn Brand DX: www.usg.com/ceilings/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.

C. Exposed Suspension System, Type 2: Galvanized steel grid and aluminum cap.
1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M. Rated for use in Kitchens and food prep areas.

2. Profile: Tee; 15/16 inch face width.
3. Finish: Baked enamel.
4. Products:
   a. Armstrong World Industries, Inc; Prelude Plus XL Fire Guard 15/16 inch: www.armstrongceilings.com.
   b. Certainteed; 15/16" EZ Stab Classic Environmental: www.certainteed.com.
   c. USG Corporation; Donn Brand ZXLA: www.usg.com/ceilings/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
   1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
   2. Gaskets For Perimeter Moldings: Closed-cell foam, factory-applied to molding.

D. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install with continuous gasket.
   2. Use longest practical lengths.
   3. Overlap and rivet corners.

E. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

F. Where round obstructions occur, provide preformed closures to match perimeter molding.

G. Install hold-down clips on panels in vestibules and within 8 ft of an exterior door.

3.05 SCHEDULE - SEE FINISH SCHEDULE ON DRAWINGS FOR ADDITIONAL DETAIL.

A. Unless Noted Otherwise: 24 by 24 inch Type 1 acoustical units, Type 1 interlocking suspension grid.

B. Kitchen Areas: 24 by 24 inch Type 2 acoustical units, Type 2 interlocking suspension grid.

END OF SECTION 09 5100

SECTION 09 6500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient base.

C. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

B. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).

B. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile 2020.

C. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of physical color samples for Architect's initial selection.

D. Verification Samples: Once preliminary color selections have been made, submit samples illustrating color and pattern for each resilient flooring product specified. Provide full size samples for LVT products, and 12 by 12 inch samples for sheet products.

E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

F. Installer's Qualification Statement.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 24 square feet of each type and color.
   3. Extra Wall Base: 48 linear feet of each type and color.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum five years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Resilient Sheet Flooring: Slip-resistant, homogeneous without backing, color and pattern throughout full thickness:
   1. Manufacturers:
      a. Altro USA, Inc.; Altro Stronghold 30: www.altrofloors.com.
      b. Forbo Flooring Systems; Eternal Step SR: www.forbo.com.
      c. Polyflor; Polysafe Apex: www.polyflor.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Thickness: 0.125 inch, nominal.
   3. Sheet Width: 6 foot 6 inches, nominal.
   4. Seams: Heat welded.
   5. Integral coved base with cap strip.
   6. Color: To be selected by Architect from manufacturer's full range.

B. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, <>.
   1. Manufacturers:
      a. Johnsonite, a Tarkett Company; Millwork, Mandalay H6: www.johnsonite.com/#sle.
      b. Mannington Commercial; Edge Effects, Simplicity 6 Inch: www.manningtoncommercial.com.
      c. Roppe Corporation; Contours Profiled Wall Base System, Vertical #65: www.roppe.com/#sle.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Height: 6 inch.
   3. Finish: Satin.
   4. Length: Roll.
   5. Color: To be selected by Architect from manufacturer's full range. Allow up to three colors.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

C. Filler for Coved Base: Plastic or metal per flooring manufacturer's recommended installation details.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 0561.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
   3. Follow moisture and alkalinity remediation procedures in Section 09 0561.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 0561 and as recommended by flooring and adhesive manufacturers.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:
   1. Spread only enough adhesive to permit installation of materials before initial set.
   2. Fit joints and butt seams tightly.
   3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

3.04 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

B. Cut sheet at seams in accordance with manufacturer's instructions.

C. Seal seams by heat welding.

D. Coved Base: Install per flooring manufacturer's recommended details, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically 4 inches minimum, and cover top edge with metal cap strip.

E. Floor Drains: Provide waterproof terminations at floor drains, cleanout covers, etc. per flooring manufacturer's recommended installation details.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION 09 6500

SECTION 09 8430
SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing wall and ceiling panels.

B. Mounting accessories.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction, edge details, and fabric covering.

F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

G. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS

A. Sound Absorbing Units: Prefinished, factory assembled fabric-covered panels.
   1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Fabric-Covered Acoustical Panels for Walls and Ceilings:
   1. Manufacturers:
      a. Acoustical Surfaces, Inc; Walls: Noise S.T.O.P. Fabrisorb, Ceilings: Ceiling Clouds : www.acousticalsurfaces.com.
      b. Armstrong; Walls and Ceilings: SoundSoak Panels : www.armstrongceilings.com.
      c. Conwed; : www.conwed.com.
      d. CMA, Inc.; : www.cmainc.net.
   2. Materials
      a. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
      b. Panel Size: As indicated on drawings.
      c. Panel Thickness: 2 inches.
      d. Edges: Perimeter edges reinforced by a formulated resin hardener.
      e. Corners: Square.

f. Fabric: Woven polyester, Guilford of Maine - Anchorage, BeeHave, FR-701 or similar.
g. Color: As selected by Architect from fabric manufacturer's full range, allow multiple colors as scheduled.
h. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.
i. Mounting Method for Wall Panels: Manufacturer's standard method for concealed support, designed to allow panel removal.

3. Mounting Method for Ceiling Panels: Horizontally suspended from ceiling.

2.02 FABRICATION

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations as indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
   1. Where radiused or mitered corners are indicated, install fabric to avoid seams or gathering of material.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch for thickness, overall length and width, and squareness from corner to corner.

2.03 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal:

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

C. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
   1. Plumb and level.
   2. Flatness.

3.03 CLEANING

A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

3.05 SCHEDULE

A. Construction Trades Building: 1 color.

END OF SECTION 09 8430

SECTION 09 9113
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Items indicated on drawings and unless otherwise indicated, including the following:
   1. Exposed surfaces of metal building frame, girts & purlins at exterior overhangs.
   2. CMU at and around window replacements on the North side of the existing building, limit work to areas of new construction to match previously painted walls.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
   6. Floors, unless specifically indicated.
   7. Ceramic and other types of tiles.
   8. Brick, unless specifically indicated.
   9. Glass.
   10. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Shop-primed items.

B. Section 09 9123 - Interior Painting.

C. Section 32 1723.13 - Painted Pavement Markings: Painted pavement markings.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

C. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

D. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit one set of paper chip samples, illustrating range of colors and textures available for each surface finishing product scheduled.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.
   2. Allow for minimum of two colors for each system, unless otherwise indicated, without additional cost to Owner.

2.02 PAINT SYSTEMS - EXTERIOR

A. Exterior Surfaces to be Painted, Unless Otherwise Indicated: concrete masonry units and primed metal.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Exterior Latex; for exterior masonry.
      a. Products:
         1) Behr Masonry, Stucco & Bick Paint Satin
         2) PPG Paints Speedhide Exterior Latex Satin, 6-2045XI Series. (MPI #15)
         3) Sherwin-Williams DuraCraft, Satin..
   3. Top Coat(s): Exterior Light Industrial Coating, Water Basedfor exterior primed metal.
      a. Products:

1) Behr Premium Interior/Exterior Direct-To-Metal Paint Semi-Gloss [No. 3200]. (MPI #163)
2) PPG Paints Pitt-Tech Plus WB DTM Industrial Enamel, 90-1210 Series, Semi-Gloss. (MPI #163)
3) Sherwin-Williams Pro Industrial DTM Acrylic Semi-Gloss Enamel, 113.06 (MPI #163)

4. Primer: As recommended by top coat manufacturer for specific substrate. Provide block filler at concrete block substrate.

2.03 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Masonry:
1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
2. Prepare surface as recommended by top coat manufacturer.

H. Ferrous Metal:
1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer<>. Protect from corrosion until coated.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance.

E. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

F. Sand metal surfaces lightly between coats to achieve required finish.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 9113

SECTION 09 9123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers and grilles to match face panels.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, and bronze items.
   6. Floors, unless specifically indicated.
   7. Ceramic and other tiles.
   8. Brick.
   9. Glass.
   10. Acoustical materials, unless specifically indicated.
   11. Concealed pipes, ducts, and conduits, unless specifically indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 2300 - Alternates: Work to be performed as part of an alternate bid.

B. Section 09 9113 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.

B. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).

C. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's product data sheets for each top coat and primer, including manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel"). Verify that top coats and primers for each paint system are listed as recommended system on product data sheets, or provide letter from paint manufacturer stating suitability of paint system for substrate.

2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit paint chip samples for color selection.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gallon of each color and sheen; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.06 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:
1. Behr Process Corporation: www.behr.com/#sle.
2. PPG Paints: www.ppgpaints.com/#sle.
3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Colors: To be selected from manufacturer's full range of available colors.

1. Selection to be made by Architect after award of contract.
2. Allow for minimum of four colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted, unless noted otherwise.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete masonry units, wood, uncoated steel, and shop primed steel.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Institutional Low Odor/VOC Interior Latex.
      a. Products: (in renovations match existing conditions iwth sheen and color)
         1) Behr Premium Plus Interior Eggshell Enamel [No. 2050].
         2) PPG Paints Pure Performance Interior Latex, 9-310XI Series, Eggshell.
         3) Sherwin-Williams ProMar 200 HP Series, Low Gloss Eg-Shel.
         4) Substitutions: Section 01 6000 - Product Requirements.
   3. Primer: As recommended by top coat manufacturer for specific substrate.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
   1. Medium duty applications include doors and door frames.
   2. Two top coats and one coat primer.
   3. Top Coat(s): Interior Light Industrial Coating, Water Based.
      a. Products:
         1) Behr Pro Pre-Catalyzed Waterborne Epoxy Semi-Gloss [No. HP150]: www.behr.com/#sle.
         2) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-510 Series, Semi-Gloss.
         3) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Semi-Gloss.
         4) Substitutions: Section 01 6000 - Product Requirements.
   4. Primer: As recommended by top coat manufacturer for specific substrate.

C. Paint I-OP-MD-WC - Medium Duty Vertical: Including gypsum board and concrete masonry units.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Interior Light Industrial Coating, Water Based.
      a. Products: (in renovations match existing color and sheen)
         1) Behr Pro Pre-Catalyzed Waterborne Epoxy Eggshell [No. HP140]: www.behr.com/#sle.
         2) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-310 Series, Eggshell.
         3) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel.
         4) Substitutions: Section 01 6000 - Product Requirements.
   3. Primer: As recommended by top coat manufacturer for specific substrate.

D. Paint I-OP-DF - Dry Fall: Overhead metals; exposed structure and overhead-mounted services, including shop primed structural steel, galvanized ducts, galvanized conduit, galvanized piping, and pre-engineered metal building framing.
   1. Shop primer by others.
   2. One top coat.
   3. Top Coat: Latex Dry Fall.
      a. Products:
         1) BEHR PRO Waterborne Acrylic Dryfall Flat No. HP210
         2) PPG Paints Speedhide Super Tech Water Based Interior Dry-Fog Latex, 6-725XI Series, Flat.
         3) Sherwin-Williams Waterborne Acrylic Dryfall, Flat.

4) Substitutions: Section 01 6000 - Product Requirements.

4. Primer: As recommended by top coat manufacturer for specific substrate.

2.04 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.

F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

G. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

H. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.05 SCHEDULE - PAINT SYSTEMS

A. Gypsum Board, CMU, Uncoated Steel and Shop Primed Steel: Finish surfaces exposed to view, except where Finish Schedule on drawings indicates "Epoxy painted". Paint shop primed structural steel beams and columns up to joist bearing elevation.
   1. Interior Walls and Structure: I-OP, eg-shel.

B. Gypsum Board: Finish surfaces of interior walls exposed to view, where Finish Schedule on drawings indicates "Epoxy painted."
   1. Interior Walls: I-OP-MD-WC, eg-shel.

C. Steel Doors and Door Frames: Finish surfaces exposed to view; I-OP-MD-DT, semi-gloss.

D. Overhead Structure, Ducts, Conduits, and Pipes, U.N.O.: Finish surfaces exposed to view; I-OP-DF, flat. Coordinate sequencing with installation of metal building insulation and liner system.

END OF SECTION 09 9123

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Room and door signs.

B. Emergency evacuation maps.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

1. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit one sample of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit one set of color selection charts or chips.

F. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

G. Manufacturer's Qualification Statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flat Signs:

1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
2. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com/#sle.
3. FASTSIGNS: www.fastsigns.com/#sle.
4. Mohawk Sign Systems, Inc: www.mohawksign.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas. Provide an additional sign from interior spaces identifying exit doors.
   1. Sign Type: Flat signs with engraved panel media as specified.
   2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
   3. Character Height: 1 inch.
   4. Sign Height: 6 inches, unless otherwise indicated.
   5. Office Doors: Identify with the room names and numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
   6. Service Rooms: Identify with the room names and numbers indicated on drawings.
   7. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers indicated on the drawings, and braille.

C. Emergency Evacuation Maps:
   1. Allow for one map per room lobby.
   2. Map content to be provided by Owner.
   3. Use clear plastic panel silk-screened on reverse, in brushed aluminum frame, screw-mounted.

2.03 SIGN TYPES

A. Flat Signs: Signage media without frame.
   1. Edges: Square.
   2. Corners: Radiused.
   3. Wall Mounting of One-Sided Signs: Tape adhesive.
   4. Glass Mounting of One-Sided Signs: Tape adhesive with blank backer sign on opposite side.

B. Color and Font: Unless otherwise indicated:
   1. Character Font: Helvetica, Arial, or other sans serif font.
   2. Character Case: Upper case only.
   3. Background Color: As selected by Architect from manufacturer's standard range.
   4. Character Color: Contrasting color.

2.04 TACTILE SIGNAGE MEDIA

A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
   1. Total Thickness: 1/16 inch.

2.05 ACCESSORIES

A. Tape Adhesive: Double sided tape, permanent adhesive.

B. Blank back-up panel for mounting on glass to conceal back side of panle signs installed on glass.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION 10 1400

SECTION 10 2113.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking and supports.

B. Section 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 2 by 2 inch in size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:
   1. All American Metal Corp - AAMCO; Phenolic Toilet Partitions: www.allamericanmetal.com/#sle.
   2. Bobrick; DuraLineSeries CGL: www.bobrick.com.
   3. Bradley; Solid Phenolic Core Partitions: www.bradleycorp.com.
   4. Partition Systems International of South Carolina; Phenolic Toilet Partitions: www.psisc.com/#sle.
   5. Substitutions: Section 01 6000 - Product Requirements.

2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted headrail-braced.
   1. Color: Single color as selected.

B. Doors:
   1. Thickness: 3/4 inch.
   2. Width: 28 inch.
   3. Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 58 inch.

C. Panels:
   1. Thickness: 1/2 inch.
   2. Height: 58 inch.
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 3/4 inch.

2. Width: As required to fit space; minimum 3 inch.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.
   1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.

B. Head Rails: Hollow stainless steel, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.

C. Wall and Pilaster Brackets: Satin stainless steel; continuous type.

D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
   1. For attaching panels and pilasters to brackets: Through-bolts and nuts ; tamper proof.

E. Hardware: Satin stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Door Latch: Slide type with exterior emergency access feature.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION 10 2113.17

SECTION 10 2800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 10 2113.19 - Plastic Toilet Compartments.

B. See drawings for accessories to be Furnished by Owner & installed by Contractor.

1.03 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

D. ASTM C1036 - Standard Specification for Flat Glass 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Bobrick Washroom Equipment, Inc.; www.bobrick.com..

B. Commercial Toilet Accessories:
   1. AJW Architectural Products; <>: www.ajw.com.
   2. ASI - American Specialties, Inc; <>: www.americanspecialties.com.
   3. Bradley Corporation; <>: www.bradleycorp.com.
   4. Substitutions: Section 01 6000 - Product Requirements.

C. Provide products of each category type by single manufacturer.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

E. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

G. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: No. 4 Brushed finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Tissue Dispenser: Furnished by Owner, installed by Contractor.

B. Paper Towel Dispenser: Furnished by Owner, installed by Contractor.

C. Soap Dispenser: Furnished by Owner, installed by Contractor.

D. Waste Receptacle: Furnished by Owner, installed by Contractor.

E. Sanitary Napkin Disposal: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
   1. Product: B254 Series by Bobrick.

F. Framed Safety Mirrors:
   1. Indicated on Drawing Schedule as "Mirror, Polished Steel": Stainless steel framed, polished stainless steel reflecting surface.
      a. Size: 24 x 60 inches or as indicated on drawings.
      b. Product: B-165 2460 manufactured by Bobrick.
   2. Indicated on Drawing Schedule as "Mirror": Stainless steel framed, 1/4 inch (6mm) thick tempered safety glass; ASTM C1048.
      a. Size: 24 x 36 inches, or as indicated on drawings.
      b. Product: B-1658 manufactured by Bobrick.
      c. Frame: 0.050 inch (1.3mm) angle shapes, with mitered, welded and ground corners, and tamperproof hanging system; stain finish.
      d. Backing: Full-mirror sized, minimum 0.030 inch (0.8mm) galvanized steel sheet and nonabsorptive filler material.
   3. Mount 24 x 60 mirrors with bottom edge 18 inches AFF.

G. Grab Bars: Stainless steel, textured surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Length and Configuration: 18, 36, 42 inch, and shower corner unit and as indicated on drawings.
      d. Products: B-5806 Series by Bobrick.

2.05 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch diameter.
   2. Hooks: 3, 0.06 inch stainless steel rag hooks at shelf front.
   3. Mop/broom holders: 4 spring-loaded rubber cam holders at shelf front.
   4. Length: 36 inches.
   5. Length: Manufacturer's standard length for number of holders/hooks.
   6. Product: B-224 manufactured by Bobrick.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.02 INSTALLATION

A. See drawings for items to be furnished by Owner and installed by Contractor.

B. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

C. Install plumb and level, securely and rigidly anchored to substrate.

D. Mounting Heights: As shown on drawings and required by accessibility regulations, unless otherwise indicated.

3.03 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION 10 2800

SECTION 11 40 00
FOOD SERVICE EQUIPMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract including general and supplementary conditions and general requirements apply to the work specified in this section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Plumbing: Refer to Division 22, including:
   1. Rough-in piping for gas and water supply and waste lines.
   2. Piping for supply and waste lines.
   3. Traps, grease traps, line strainers, tail pieces, valves, stops, shut-offs and miscellaneous fittings required for complete installation.
   4. Final connections.
   5. Indirect drains for sink compartments.

B. Mechanical: Refer to Division 23, including:
   1. Kitchen Exhaust Hoods complete with roof mounted fans and connecting ductwork.
   2. Fire suppression systems for kitchen exhaust hoods

C. Electrical: Refer to Division 26, including:
   1. Rough-in conduit, wiring, line and disconnect switches, safety cut-offs and fittings, control panels, fuses, boxes and fittings required for complete installation.
   2. Final connections, including mounting and wiring of switches furnished as part of the food service equipment (unless otherwise indicated on the drawings).

1.3 WORK INCLUDED THIS SECTION:

A. Furnish and install all food service equipment as specified herein, including that which is reasonably inferred, with all related items necessary to complete work shown on contract drawings and/or required by these specifications.

B. Electrical Work:
   1. Interwiring of food service equipment between components within equipment, such as heating elements, switches, thermostats, motors, etc., complete with junction box as is applicable, ready for final connection.
   2. Voltages shall be as indicated on contract drawings. Any differences in electrical characteristics at job site from those shown on contract documents must be submitted to Architect for consideration prior to ordering equipment.

C. Plumbing Work:
   1. Furnish all equipment with faucets, sink waste assemblies, and trim as specified in this section.
   2. Other than sink compartments, extend all indirect waste lines to nearest floor receptor. All such drain lines to be properly sized. Drain shall terminate with proper air gap above flood rim of floor receptor. Drain lines to be copper with silver paint unless specified otherwise. Drain lines in public areas to be chrome plated where exposed to view.

1.4 QUALITY ASSURANCE

A. It is required that all custom fabricated equipment such as food serving units, tables, sinks, counter tops, etc., be manufactured by a food service equipment fabricator who has the plant, personnel and engineering equipment required. Such manufacturer shall be subject to approval of Architect.
   All work in above category shall be manufactured by one manufacturer and shall be of uniform design and finish.

B. Manufacturer of this equipment must be able to show that he is now and for the past five years has been engaged in manufacture or distribution of equipment, as required under this contract, as his principal product.

C. Manufacturer of equipment herein specified shall be a recognized distributor for items of equipment specified herein which are of other manufacture than his own.

1.5 SUBMITTALS

A. Submit shop drawings as required by General Conditions. All shop drawings and rough-in drawings shall be CAD drafted and must be submitted in .DWF or .PDF electronic format. Multiple hard copies are not acceptable.

B. Shop drawings and bound brochures covering manufactured or "buy-out" items covering all work and equipment included in this contract shall be submitted to Architect as soon as possible after award of contract. After approval, Food Service Equipment Contractor shall furnish to Architect electronic files of shop drawings and brochures, corrected as required by virtue of review comments, for distribution to various interested trades on project. All costs of reproduction and submission shall be part of contract.
Bound brochure and cut sheet submittals must be copied to Owner for review and comment.

C. Provide fully dimensioned rough-in plans at 1/4" scale, consisting of a separate drawing for each discipline. Each drawing shall show equipment shaded down 50%. Rough-in set shall include all required mechanical, electrical, plumbing, services for equipment and dimensioned rough-in location for same. Rough-in locations shown shall make allowances for required traps, switches, etc., thereby not requiring interpretation or adjustment on the part of other Contractors.
Drawings shall indicate dimensions for floor depressions, wall openings, etc., for equipment. Food Service Equipment Contractor shall visit site to verify all rough-in and sleeve locations prior to installation of finished floors and shall cooperate with other Contractors involved in proper location of same. Food Service Equipment Contractor shall be responsible for any required relocations of rough-in due to errors or inaccuracies on those rough-in plans which he prepares.

D. Rough-in plans shall include all required services which relate to equipment, but which may not directly connect thereto, such as convenience outlets at walls, hose stations, floor drains, etc.

E. Rough-in plans shall also include all required outlet services for equipment which is on drawing schedule, even though such equipment may not be included in this designated contract.

F. Fully dimensioned and detailed shop drawings of custom fabricated equipment items shall be submitted, drawn at 3/4" and 1 - 1/2" scale for plans, elevations, and sections respectively.
Drawings shall show all details of construction, installation, and relation to adjoining and related work where cutting or close fitting is required. Drawings shall show all reinforcements, anchorage, and other work required for complete installation of all fixtures.

G. Do not begin fabrication of custom manufactured equipment until approvals of shop drawings have been received and until field measurements have been taken by Food Service Equipment Contractor, where such measurements are necessary to assure proper conformance with intent of contract drawings and specifications.

H. Make field measurements, giving due consideration to any architectural, mechanical, or structural discrepancies which may occur during construction of building. No extra compensation will be allowed for any difference between actual measurements secured at job site and dimensions indicated on contract drawings. Any differences which may be found at job site during field measurements shall be submitted to Architect for consideration before proceeding with fabrication of equipment.

I. Submit illustrative brochures for manufactured or "buy-out" equipment items, complete with illustrations, specifications, line drawings, rough-in requirements, and list of accessories or other specified additional requirements. Brochures shall be bound and shall include data on all equipment which is to be provided, arranged in numerical sequence which conforms to

item numbers of specifications. Omission of data does not reduce obligation to provide items as specified.

J. Approval of shop schedules and brochures will be in general and shall be understood to mean that Architect has no objection to use of materials or processes shown. Approval does not relieve Food Service Equipment Contractor from responsibility for errors, omissions, or deviations from contract requirements.

1.6 SUBSTITUTIONS - STANDARDS

A. Refer to Instructions to Bidders and Division 01 for requirements.

B. All unspecified substitutions after bid must be submitted to Owner for written approval prior to acceptance.

1.7 DRAWINGS

A. Drawings which constitute part of contract documents indicate general arrangement of piping and location of equipment. Should it be necessary to deviate from arrangement indicated in order to meet structural conditions, make such deviations without expense to Owner.

B. Specifications and drawings are reasonably exact, but their extreme accuracy is not guaranteed. Drawings and specifications are for assistance and guidance of Contractor, and exact locations, distances and levels shall be governed by the building.

1.8 MANUFACTURER'S DIRECTIONS

A. Follow manufacturer's directions in all cases where manufacturers of articles used in this contract furnish directions or prints covering points not shown on drawings or specifications.

1.9 INDUSTRY STANDARDS

A. Electric operated and/or heated equipment, fabricated or otherwise, shall conform to latest standards of National Electric Manufacturers Association and of Underwriters Laboratories, Inc., and shall bear the U.L. label.

B. Cooking and hot food holding equipment shall meet minimum construction standards as noted by NSF #4.

C. Refrigeration equipment shall meet minimum construction standards as noted by NSF #7.

D. Items of food service equipment furnished shall bear the N.S.F. seal.

E. Food service equipment shall be installed in accord with N.S.F. standards.

F. Work and materials shall be in compliance with requirements of applicable codes, ordinances and regulations, including but not limited to those of Occupational Safety and Health Act (OSHA), National Fire Protection Association, State Fire Marshal, State Accident Commission, U.S. Public Health Service, State Board of Health, local health codes, etc.

G. No extra charge will be paid for furnishing items required by regulations, even though such may not be shown on drawings or called for in these specifications.

H. Rulings and interpretations of enforcing agencies shall be considered part of regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURED EQUIPMENT

A. All like types of equipment such as all refrigerated and heated cabinets, all ovens, and all mixers shall be by the same manufacturer.

B. Except as may be specified otherwise under individual item specifications in “Equipment Schedule", all items of standard manufactured equipment shall be complete in accord with manufacturer's standard specification for specific unit or model called for, including finishes, components, attachments, appurtenances, etc., except as follows:

C. All items of standard equipment shall be that manufacturer's latest model at time of delivery.

D. Substitutions for manufactured equipment specified will be accorded consideration under terms set forth in "Substitutions - Standards".

2.2 FABRICATED EQUIPMENT

A. Stainless steel shall be U.S. standard gauges as called for, 18-8, Type 302, Type 304, No. 4 finish.

B. Galvanized iron shall be Armco or equal. Framework of galvanized iron shall be welded construction, having welds smooth, and where galvanizing has been burned off, touched up with high grade aluminum bronze.

C. Legs and crossrails shall be continuously welded, unless otherwise noted, and ground smooth.

D. Bottom of legs at floor shall be fitted with sanitary stainless-steel bullet type foot, with not less than 2" adjustment.

E. Legs shall be fastened to equipment as follows:

1. To sinks by means of closed gussets. Gussets shall be stainless steel, reinforced with bushing, having set screws for securing legs.
2. To tables and drainboards with closed gussets which shall be welded to stainless steel hat sections or channels, 14 gauge or heavier, exposed hat sections having closed ends. Bracing shall be welded to underside of tops.

F. Closed gussets shall be a 3" minimum diameter at top, continuously welded to frame members or to sink bottom.

G. Sinks, unless otherwise specified, shall be furnished with rotary type waste outlets, without connected overflows: Atlantic Brass Works Model 772-RB; Fisher Brass Foundry Model 250A; T&S; or approved equal. Where exposed, furnish wastes chromium plated.

H. Rolls shall be 1 1/2" diameter, except as detailed contrary, with corners bullnosed, ground and polished.

I. Seams and joints shall be shop welded. Welds to be ground smooth and polished to match original finish. Materials 18 gauge or heavier shall be welded.

J. Metal tops shall be one-piece welded construction, unless specified otherwise, reinforced on underside with stainless steel hat sections or channels welded in place. Crossbracing to be not more than 30" on centers.

K. Fabricate sink compartments with fully coved vertical and horizontal corners. Multiple compartment partition to be double thickness, continuously welded where sheets join at top. Front of multiple compartment sinks to be continuous on exterior. Bottoms shall be creased to drain.

L. Ends of all fixtures, splashbacks, shelves, etc., shall be finished flush to walls or adjoining fixtures.

M. Dishtables, draintables, splashbacks and turned-up edges shall have radius bends in all horizontal and vertical corners, coved at intersections.

N. Rounded and coved corners or radius bends shall be 1/2" radius or longer.

2.3 HEATING EQUIPMENT

A. Wherever electric heating equipment or thermostat control for such equipment is specified, it shall be complete, and of the materials, size and rating specified within equipment item or details. All such equipment shall be designed and installed to be easily cleaned or to be easily removed for cleaning.

B. Electrical appliances or heating element circuits of 120 volts shall not exceed 1650 watts, unless specifically shown contrary.

2.4 SWITCHES AND CONTROLS

A. Food Service Equipment Contractor shall supply on each motor driven appliance or electrical heating unit suitable control switch of proper type in accord with Underwriter's Code.

B. All internal wiring for fabricated equipment items included, all electrical devices, wiring, controls, switches, etc., built into or forming an integral part of these items shall be furnished and installed by Food Service Equipment Contractor in his factory or building site with all items complete to junction box for final connection to building lines by Electrical Contractor.

C. Provide standard 3-prong plugs to fit "U" slot grounding type receptacles, similar to No. 5262, for all equipment items powered by plugging into 110-120 volts, single phase AC. Also, provide suitable length 3-wire cord for equipment.

2.5 CONNECTION TERMINALS

A. All equipment shall be complete with connection terminals as standardized by equipment manufacturers, except where specified otherwise.

2.6 LOCKS

A. Fit all doors for reach-in refrigerated compartments with locking type latches. Provide master keys.

2.7 GAS EQUIPMENT

A. Equipment to be suitable for use with gas available at site, and to be furnished by F.S.E.C. with pressure regulators designed to work with incoming pressure.

2.8 GAS QUICK DISCONNECTS

A. Where specified, gas quick disconnects shall be furnished complete with gas valve, gas connector hose, quick disconnect fitting elbows, and restraining cable, all AGA approved. Gas hose shall be flexible, braided or corrugated stainless steel with smooth plastic exterior coating or sleeve of heat shrink tubing (provide on all caster mounted gas equipment).

B. All mobile cooking equipment requiring surface protection by fire suppression nozzles shall be secured in place by stainless steel cradle type wheel stops as manufactured by the Eagle Group or Select Stainless products. Plastic wheel stops are not acceptable.

PART 3 - EXECUTION

3.1 GENERAL

A. Work under this contract and covered under this section of specifications includes but is not limited to:

1. Cutting of holes and/or ferrules on equipment for piping, drains, electrical outlets, conduits, etc. as required to coordinate installation of food service equipment with work of other Contractors on project.
2. Field checking of building and rough-in requirements, and submission of brochures and shop drawings, all as required hereinbefore under "Submittals".
3. Repair of all damage to premises as result of this installation, and removal of all debris left by those engaged in this installation.
4. Having all food service equipment fixtures completely cleaned and ready for operation when building is turned over to Owner.

3.2 INSTALLATION PROCEDURES

A. Food Service Equipment Contractor shall make arrangements for receiving his custom fabricated and "buy out" equipment and shall make delivery into building as requisitioned by his installation superintendent. He shall not consign any of his equipment to Owner or to any other Contractor unless he has written acceptance from them and has made satisfactory arrangements for the payment of all freight and handling charges.

B. Food Service Equipment Contractor shall deliver all of his custom fabricated and "buy out" equipment temporarily in its final location, permitting Trades to make necessary arrangements for connection of service lines; he shall then move equipment sufficiently to permit installation of service lines, after which he shall realign his equipment level and plumb, making final erection as shown on contract drawings.

C. All portable or counter mounted equipment weighing in excess of 25 pounds shall be mounted on 4" stainless steel adjustable legs.

D. This Contractor shall coordinate his work and cooperate with other trades working at site toward the orderly progress of the project.

E. Architect or Owner's Agent shall have access at all times to plant or shop in which custom fabricated equipment is being manufactured, from time contract is let until equipment is shipped, in order that progress of work can be checked, as well as any technical problem which may arise in coordination of equipment with building. Any approval given at this point of manufacture shall be tentative, subject to final inspection and test after complete installation.

F. Food Service Equipment Contractor shall assist Architect, Owner, and/or Owner's Agent in making any desired tests during or prior to final inspection of equipment; he shall remove immediately any work or equipment rejected by Architect, Owner, and/or Owner's Agent, replacing same with work conforming with contract requirements, and shall reimburse mechanical and/or other contractors involved for extra work made necessary by such replacement.

G. This Contractor shall keep premises free from accumulation of his waste material and rubbish, and at completion of his work shall remove his rubbish and implements, leaving areas of his work broom clean.

H. This Contractor shall provide and maintain coverings or other approved protection for finished surfaces and other parts of his equipment subject to damage during and after erection. After removal of protective coverings, all field joints shall be ground and polished, and entire work shall be thoroughly cleaned and polished.

3.3 TRIMMING AND SEALING EQUIPMENT

A. Seal completely spaces between all units to walls, ceilings, floors, and adjoining (not portable) units with enclosed bodies against entrance of food particles or vermin by means of trim strips, welding, soldering, or commercial joint material best suited to nature of equipment and adjoining surface material.

B. Close ends of all hollow sections.

C. Equipment butting against walls, ceilings, floor surfaces and corners to fit tightly against same; backsplashes or risers which fit against wall to be neatly scribed and sealed to wall with DowCorning # 732 RTV or General Electric clear silicone sealant, wiping excess sealant out of joint to fillet radius. Where required to prevent shifting of equipment and breaking wall seal, anchor item to floor or wall.

D. Treat enclosed spaces (inaccessible after equipment installation) for vermin prevention in accord with industry practice.

3.4 TESTING AND DEMONSTRATION OF EQUIPMENT

A. After completion of installation, all equipment using water, gas, and electricity shall be performance inspected and tested by factory certified service agent, including wet test of hood fire suppression systems, if so required. Food Service Equipment Contractor shall document that these inspections have been performed prior to scheduling demonstrations and Owner acceptance of equipment.

B. Food Service Equipment Contractor shall arrange to have all manufactured, mechanically operated equipment furnished under this contract demonstrated by authorized representatives of equipment manufacturers, these representatives to instruct Owner's designated personnel in use, care and maintenance of all items of equipment after same are in working order. Demonstration and instruction shall be held on dates designated by Owner.

C. Food Service Equipment Contractor shall provide a competent service representative to be present when installation is put into operation.

3.5 EQUIPMENT HANDLING AND STORAGE

A. Deliver equipment to site, properly crated and protected, and store in safe place, protected from damage until time for installation.

3.6 GUARANTEE

A. Special Project Warranty: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required, provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. This warranty shall be in addition to, and not limitation of, the rights the Owner may have against the Contractor under the Contract Documents.

B. Warranty Period:
1 year from date of Substantial Completion, all new equipment furnished. However, manufacturer's warranty shall prevail when the period is longer than one year.
5 years warranty period on refrigeration compressors.
10 years warranty period on walk-in panels.

3.7 OPERATING AND MAINTENANCE MANUALS

A. After completion of installation, Food Service Equipment Contractor shall present to Owner three sets of all operating and maintenance manuals, covering all mechanically operated equipment furnished under this contract, each set being neatly bound in looseleaf binder having durable cover.

B. Include in each binder a list of names, addresses and telephone numbers of local servicing agencies authorized to make necessary repairs and/or adjustments of equipment furnished under this contract.

PART 4 – EQUIPMENT SCHEDULE

ITEM 01 REACH-IN REFRIGERATOR EXISTING, RESET

This item is to be reset from Owner's existing facility, by Food Service Equipment Contractor.

ITEM 02 REACH-IN REFRIGERATOR QUANTITY AS SCHEDULED

Provide reach-in refrigerator with the following features:
A. Reach-in
B. Two-section
C. 45.2 cu. ft.
D. (1) Right-hand solid hinged door, (1) left-hand solid hinged door
E. Door locks
F. (6) Shelves
G. Electronic control
H. LED interior lighting
I. Digital display
J. Stainless steel exterior & interior
K. Top-mounted self-contained refrigeration
L. Variable speed technology
M. 6" Heavy duty casters, (2) locking
N. Voltage as scheduled, cord and plug

Reach-in refrigerator to be as manufactured by Beverage Air, Model No. HRPS2HC-1S, Continental, or True.

ITEM 03 REACH-IN FREEZER QUANTITY AS SCHEDULED

Provide reach-in freezer with the following features:
A. Reach-in
B. Two-section
C. 40 cu. ft.

D. (2) Solid hinged doors with locks
E. (6) Adjustable shelves
F. Electronic control
G. LED interior lighting
H. Automatic defrost
I. Top-mounted self-contained refrigeration
J. Stainless steel interior & exterior
K. R290 Hydrocarbon refrigerant
L. Voltage as scheduled, cord and plug

Reach-in freezer to be as manufactured by Beverage Air, Model No. TMF2HC-1S, Continental, or True.

ITEM 04 PLASTIC SHELVING UNIT N.I.K.C.

This item to be furnished and installed by owner.

ITEM 05 HAND SINK QUANTITY AS SCHEDULED

Provide hand sink with the following features:
A. Wall mount
B. 13-1/2" Wide x 9-3/4" front-to-back x 6-3/4" deep bowl
C. 304 Stainless steel construction
D. Splash mount gooseneck faucet
E. Deep-drawn seamless design-positive drain
F. Inverted "V" edge

Hand sink to be as manufactured by Eagle Group, Model HSA-10-, Advance Tabco, Titan Stainless, or John Boos.

ITEM 06 2-COMPARTMENT SINK EXISTING, RESET

This item is to be reset from Owner’s existing facility, by Food Service Equipment Contractor.

ITEM 07 WORK TABLE, 60”, S/S TOP N.I.K.C.

This item to be as furnished and installed by owner.

ITEM 08 1-COMPARTMENT SINK EXISTING, RESET

This item is to be reset from Owner’s existing facility, by Food Service Equipment Contractor.

ITEM 09 DROP-IN SINK QUANTITY AS SCHEDULED

Provide sink with the following features:
A. Drop-in
B. 1-Compartment
C. 10" Wide x 14" front-to-back x 10" deep bowl
D. 20 Gauge 304 stainless steel
E. With deck mounted gooseneck faucet
F. Lever drain

Drop-in sink to be as manufactured by Advance Tabco, Model No. DI-1-10, Eagle Group, Titan Stainless, or John Boos.

ITEM 10 RANGE, 36", 4 OPEN BURNERS, 12" GRIDDLE QUANTITY AS SCHEDULED

Provide gas range with the following features:

A. Gas
B. 36”
C. (4) 32,000 BTU open burners
D. (1) 12" griddle, 5/8" thick smooth steel plate, centered
E. Convection oven base
F. (3) Oven racks
G. 3-Position rack guides
H. Stainless steel construction
I. Casters with brakes
J. Caster cradle stabilizing device
K. Voltage as scheduled, cord and plug
L. Low profile backguard, in lieu of standard high shelf

Gas range to be as manufactured by Garland/US Range, Model No. U36-4G12C, Vulcan, or Southbend.

ITEM 11	DEMONSTRATION COOK TABLE	QUANTITY AS SCHEDULED

This item to be custom fabricated in accord with General Requirements of specifications and with plan and detail drawings.

ITEM 12	SINGLE ISLAND EXHAUST HOOD	N.I.K.C. (BY HVAC)
ITEM 13	MULTI-COOK OVEN (FUTURE)	N.I.K.C.
ITEM 14	EXHAUST HOOD	N.I.K.C. (BY HVAC)
ITEM 15	FIRE SUPPRESSION SYSTEM	N.I.K.C. (BY HVAC)
ITEM 16	WORK TABLE, 84”, S/S TOP	N.I.K.C. (BY OWNER)
ITEM 17		NOT USED
ITEM 18		NOT USED
ITEM 19	WORK TABLE, 24”, S/S TOP	N.I.K.C. (BY OWNER)
ITEM 20	DISHWASHER, UNDERCOUNTER	N.I.K.C.(FUTURE)
ITEM 21	THREE (3) COMPARTMENT SINK	QUANTITY AS SCHEDULED

Provide three compartment sink with the following features:
A. Three 20” W x 28” Front to Back x 14: D sink compartments
B. One set of centered faucet holes with HD Splash mount 14” swing spout faucet.
D. Lever wastes.
E. 10"H backsplash with 45° top and 2" return
F. 30" Left & right drainboards
G. 14/300 Stainless steel construction
H. Stainless steel legs with front & side bracing, and adjustable bullet feet.

Three-compartment sink to be as manufactured by John Boos, Model No. 43PB20284-2D30, Eagle Group, Titan Stainless, or Advance Tabco.

ITEM 22	OVERSHELF	QUANTITY AS SCHEDULED

Provide overshelf with the following features:
A. 96"W x 12"D x 9-1/2"H overall size
B. Wall mounted, with pot rack
C. 1-1/2” Rear upturn, safety edge front
D. Includes (8) stainless steel hooks
E. 16/300 Stainless steel
Sorting shelf to be as manufactured by John Boos, Model No. BHS1296PR-16/304, Eagle Group, Titan Stainless, or Advance Tabco.

ITEM 23	PLASTIC SHELVING UNIT	N.I.K.C. (BY OWNER)
ITEM 24		NOT USED
ITEM 25	ESPRESSO CAPPUCCINO MACHINE	N.I.K.C. (BY OWNER)
ITEM 26	UNDERCOUNTER REFRIGERATOR	QUANTITY AS SCHEDULED

Provide undercounter refrigerator with the following features:
A. One-section
B. 27"W, 6.13 cu. ft.
C. (1) Door, (2) shelves
D. Stainless steel exterior front, sides, door, top & grille, aluminum interior
E. Rear-mounted self-contained refrigeration
F. R290 Hydrocarbon refrigerant
G. Set of (4) casters, 1.25"Diameter, including mounting hardware
H. Voltage as scheduled, cord and plug
Undercounter refrigerator to be as manufactured by Beverage Air, Model No. UCR27AHC, Continental, or True.

ITEM 27	DROP-IN SINK	QUANTITY AS SCHEDULED

Provide sink with the following features:
A. Drop-in
B. 1-Compartment
C. 10" Wide x 14" front-to-back x 10" deep bowl
D. 20 Gauge 304 stainless steel
E. With deck mounted gooseneck faucet
F. Basket drain
Drop-in sink to be as manufactured by Advance Tabco, Model No. DI-1-10, Eagle Group, Titan Stainless, or John Boos.

ITEM 28	DROP-IN ICE BIN	QUANTITY AS SCHEDULED

Provide drop-in ice bin with the following features:
A. With 11.5” x 8.5” x 5.5” sink
B. 21"W x 18"D OA, ice bin on right with 11" deep liner & removable sliding lid
C. 5-1/2" Deep sink bowl with 4" OC deck mount faucet
D. Includes drain
E. 304 Stainless steel construction
Drop-in ice bin with sink to be as manufactured by BK Resources, Model No. BK-DIBHL-2118-P-G. or equal fabrication by Advance Tabco, Eagle Group, or John Boos.

ITEM 29	BUSSING UTILITY TRANSPORT CART	N.I.K.C.

This item to be furnished and installed by Owner.

ITEM 30	ICE MAKER WITH BIN, CUBE-STYLE	QUANTITY AS SCHEDULED

Provide ice maker with the following features:
A. Air-cooled
B. Self-contained refrigeration
C. 0.81 Cube size
D. Production capacity up to 65 lb/24 hours at 70°/50° (61 lb at 90°/70°)
E. 20 Lbs. storage capacity
F. Electro-mechanical operation
G. Scotch bright finish
H. Adjustable feet
I. R290 Hydrocarbon refrigerant
J. Voltage as scheduled, cord and plug
K. Water filtration system
L. Backflow prevention device

Ice maker to be as manufactured by Eurodib USA, Model No. CB249A BHC AWS, Ice-O-Matic, or Scotsman.

ITEM 31	ICED TEA BREWER	N.I.K.C. (BY OWNER)
ITEM 32	COFFEE BREWER	N.I.K.C. (BY OWNER)
ITEM 33	POS STATION	N.I.K.C. (BY OWNER)
ITEM 34	BLENDER, BAR	N.I.K.C. (BY OWNER)

END OF SECTION 114000

SECTION 12 2400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

1.02 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films 2023.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

B. Sequencing:
   1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
   2. Do not install shades until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.

C. Shop Drawings: Include head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.

D. Selection Samples: Include fabric samples in full range of available colors and patterns.

E. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.

F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.06 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Fabric: One year.
   3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades:
   1. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural; RB500 Manual Roller Shades: www.hunterdouglasarchitectural.com/#sle.

3. Levolor; Manually Operated Roller Shades: www.commercial.levolor.com/#sle.
4. TimberBlindMetroShade; SolarVue Manual Roller Shade: www.timberblinds.com/commercial-division/#sle.
5. SWFcontract, a division of Springs Window Fashions, LLC.; Manual Roller Shades: www.swfcontract.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROLLER SHADES

A. General:
1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
2. Provide shade system that operates smoothly when shades are raised or lowered.

B. Roller Shades Type _____:
1. Description - Interior Roller Shades: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and accessories.
   a. Roll Direction: Roll down, closed position is at window sill.
   b. Mounting: Window jamb mounted - outside face of storefront jambs, inside of drywall return.
2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
3. Roller Tubes: As required for type of shade operation.
4. Hembars: Designed to maintain bottom of shade straight and flat.
   a. Style: Full wrap fabric covered bottom bar, flat profile with heat sealed closed ends.
5. Manual Operation for Interior Shades:
   a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   b. Drive Chain: Continuous loop beaded ball chain, 95 lb minimum breaking strength. Provide upper and lower limit stops.
   c. Chain Retainer:
      1) Manufacturer's standard clip.
6. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to brackets without exposed fasteners; baked enamel finish.
      1) Color: as selected from standard color options.
      2) Profile: Square.
   b. End Caps: Provide manufacturer's standard end caps to cover exposed ends of brackets.
   c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. Fabric for Light-Filtering Shades: Nonflammable, color-fast, impervious to heat and moisture, and able to retain its shape under normal operation.
1. Manufacturers:
   a. Mermet Corporation; E-Screen: www.mermetusa.com/#sle.
   b. Phifer, Inc; Sheer Weave: www.phifer.com/#sle.
   c. Serge Ferrari; Soltis: www.sergeferrari.com/#sle.
   d. Substitutions: See Section 01 6000 - Product Requirements.
2. Performance Requirements:
   a. Flammability: Pass NFPA 701 large and small tests.
3. Openness Factor: 10%.
4. Color: As selected by Architect from manufacturer’s full range of colors.
5. Fabrication:
   a. Fabric Orientation: Railroaded, fabric is turned 90 degrees off the roll.
   b. Battens: Full width of shade, enclose in welded shade fabric pocket.

2.04 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.
   1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch space between bottom bar and window stool.
   2. Horizontal Dimensions - Outside Mounting: Cover window frames, trim, and casings completely.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.06 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION 12 2400

SECTION 12 3600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.02 RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2015.

B. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.

C. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

C. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

D. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate. For use as window stools.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Manufacturers:
         1) Avonite Surfaces; Solid Surface: www.avonitesurfaces.com/#sle.
         2) Dupont; Corian: www.corian.com/#sle.
         3) Formica Corporation; Everform : www.formica.com/#sle.
         4) Meganite, Inc; Solid Surface: www.meganite.com/#sle.
         5) Wilsonart; Solid Surface: www.wilsonart.com/#sle.
         6) Substitutions: See Section 01 6000 - Product Requirements.
      b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
      c. Color and Pattern: As selected by Architect from manufacturer's standard line.
   3. Other Components Thickness: 1/2 inch, minimum.

B. Stainless Steel Countertops: , Type 304, stainless steel sheet; 16 gauge, 0.0625 inch nominal sheet thickness.
   1. Finish: 4B satin brushed finish.
   2. Exposed Edge Shape: Straight turndown with return; 1-1/2 inch high face, 1 inch return to face of case .
   3. Splash Dimensions: 6 1/2 inch high with 1/2 incg and 6 1/4 inch return, as shown on drawings.

2.02 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.

C. Stainless Steel: Fabricate tops up to 144 inches long in one piece including nosings and back and end splashes; accurately fitted mechanical field joints in lengths over that dimension are permitted.
   1. Weld joints; grind smooth and polish to match.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.02 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach stainless steel countertops using stainless steel fasteners and adhesive.

C. Seal joint between back/end splashes and vertical surfaces.

3.03 CLEANING

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 12 3600

SECTION 133419 - METAL BUILDING 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. Section Includes:

1. Structural-steel framing.
2. Metal roof panel coordination.
3. Metal wall panel coordination.
4. Thermal insulation coordination.
5. Accessories.

B. Related Sections:
1. Section 07 2100-Insulation.
2. Section 07 4213-Metal Roof and Wall Panels.
3. Section 07 9200-Joint Sealants.
4. Section 08 3323-Overhead Coiling Doors.
5. Section 08 3613-Sectional Doors.
6. Section 08 4313-Aluminum-Framed Storefronts.
7. Section 08 6200-Unit Skylights.

1.3 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

1. Structural-steel-framing system.
2. Metal roof panels.
3. Metal wall panels.
4. Flashing and trim.
5. Accessories.

B. Shop Drawings: For the following metal building system components. Include plans, elevations, sections, details, and attachments to other work.

1. Anchor-Bolt Plans: Submit anchor-bolt plans and templates before foundation work begins. Include location, diameter, and projection of anchor bolts required to attach metal building to foundation. Indicate column reactions at each location.
2. Structural-Framing Drawings: Show complete fabrication of primary and secondary framing; include provisions for openings. Indicate welds and bolted connections, distinguishing between shop and field applications. Include transverse cross-sections.

    a. Show provisions for attaching roof curbs for skylights.

3. Metal Roof and Wall Panel Layout Drawings: Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

    a. Show roof-mounted items including roof skylights, equipment supports, pipe supports and penetrations, and items mounted on roof curbs.
    b. Show wall-mounted items including doors, windows, and lighting fixtures.

4. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

    a. Flashing and trim.
    b. Roof ventilators.

C. Delegated-Design Submittal: For metal building 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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified erector, manufacturer and testing agency.

B. Manufacturer Accreditation: Statement that metal building system and components were designed and produced by a manufacturer accredited according to the International Accreditation Service's AC472.

C. Welding certificates.

D. Metal Building System Certificates: For each type of metal building system, from manufacturer.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

    a. Name and location of Project.
    b. Order number.
    c. Name of manufacturer.
    d. Name of Contractor.
    e. Building dimensions including width, length, height, and roof slope.

f. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
g. Governing building code and year of edition.
h. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
i. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
j. Building-Use Category: Indicate category of building use and its effect on load importance factors.

E. Erector Certificates: For each product, from manufacturer.

F. Manufacturer Certificates: For each product, from manufacturer.

G. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop primers.
5. Nonshrink grout.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

I. Source quality-control reports.

J. Field quality-control reports.

K. Warranties: Sample of special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes and door hardware to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.

1. Accreditation: According to the International Accreditation Service's AC472.
2. Engineering Responsibility: Preparation of comprehensive engineering analysis and Shop Drawings by a professional engineer who is legally qualified to practice in jurisdiction where Project is located.

B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this Project and who is acceptable to manufacturer.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

D. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

E. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3, "Structural Welding Code - Sheet Steel."

F. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

G. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

H. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to metal building systems including, but not limited to, the following:

    a. Condition of foundations and other preparatory work performed by other trades.
    b. Structural load limitations.
    c. Construction schedule. Verify availability of materials and erector's personnel, equipment, and facilities needed to make progress and avoid delays.
    d. Required tests, inspections, and certifications.
    e. Unfavorable weather and forecasted weather conditions.

2. Review methods and procedures related to metal roof panel assemblies including, but not limited to, the following:

    a. Compliance with requirements for purlin and rafter conditions, including flatness and attachment to structural members.
    b. Structural limitations of purlins and rafters during and after roofing.
    c. Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
    d. Temporary protection requirements for metal roof panel assembly during and after installation.
    e. Roof observation and repair after metal roof panel installation.

3. Review methods and procedures related to metal wall panel assemblies including, but not limited to, the following:

a. Compliance with requirements for support conditions, including alignment between and attachment to structural members.
b. Structural limitations of girts and columns during and after wall panel installation.
c. Flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
d. Temporary protection requirements for metal wall panel assembly during and after installation.
e. Wall observation and repair after metal wall panel installation.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, 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.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when weather conditions permit metal panels to be installed according to manufacturers' written instructions and warranty requirements.

B. Field Measurements:

1. Established Dimensions for Foundations: Comply with established dimensions on approved anchor-bolt plans, establishing foundation dimensions and proceeding with fabricating structural framing without field measurements. Coordinate anchor-bolt installation to ensure that actual anchorage dimensions correspond to established dimensions.
2. Established Dimensions for Metal Panels: Where field measurements cannot be made without delaying the Work, either establish framing and opening dimensions and proceed with fabricating metal panels without field measurements, or allow for field trimming metal panels. Coordinate construction to ensure that actual building dimensions, locations of structural members, and openings correspond to established dimensions.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete, reinforcement, and formwork requirements are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate installation of roof curbs equipment supports and roof penetrations, which are specified in Section 077200 "Roof Accessories."

C. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A&S Building Systems, Inc.; Division of NCI Building Systems, L.P.
2. Alliance Steel, Inc.
3. American Buildings Company; Division of Magnatrax Corp.
4. American Steel Building Co., Inc.
5. Ascent Buildings, LLC.
6. Behlen Mfg. Co.
7. Butler Manufacturing Company; a BlueScope Steel company.
8. Ceco Building Systems; Division of NCI Building Systems, L.P.
9. Chief Buildings; Division of Chief Industries, Inc.
10. Elite Structures, Inc.
11. Inland Buildings; Subsidiary of Behlen Mfg. Co.
12. Kirby Building Systems; Division of Magnatrax Corp.
13. Mesco Building Solutions; Division of NCI Building Systems, L.P.
14. Metallic Building Company; Division of NCI Building Systems, L.P.
15. Metco Metal Supply.
16. Nucor Building Systems.
17. Spirco Manufacturing.
18. Star Building Systems; an NCI company.
19. Tyler Building Systems, L.P.
20. USA, Inc.
21. VP Buildings; a United Dominion company.
22. Vulcan Steel Structures, Inc.

2.2 METAL BUILDING SYSTEMS

A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

1. Provide metal building system of size and with bay spacings, roof slopes, and spans as indicated on drawings.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

C. Additional Framing: Columns as required to support open bays on ends of building.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and flush-framed girts.

E. Eave Height: As indicated on Drawings.

F. Bay Spacing: As indicated on Drawings.

G. Roof Slope: As indicated on Drawings.

H. Roof System: See Section 07 4213-Metal Roof and Wall Panels.

I. Exterior Wall System: See Section 07 4213-Metal Roof and Wall Panels.

J. Exterior Wall System: Manufacturer's standard foam-insulation-core metal wall panels.

2.3 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:

    a. Purlins and Rafters: Vertical deflection of 1/150 of the span.
    b. Girts: Horizontal deflection of 1/180 of the span.
    c. Metal Roof Panels: Vertical deflection of 1/60 of the span.
    d. Metal Wall Panels: Horizontal deflection of 1/60 of the span.
    e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.

3. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:

    a. Lateral Drift: Maximum of 1/60 of the building height.

4. Metal panel assemblies shall withstand the effects of gravity loads and loads and stresses within limits and under conditions indicated according to ASTM E 1592.

C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering 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, material surfaces.

E. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E 1646 at test-pressure difference of 2.86 lbf/sq. ft.

F. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E 331 at a wind-load design pressure of not less than 2.86 lbf/sq. ft.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with uplift requirements listed on drawings.

H. Thermal Performance: In conjunction with insulation materials specified in Section 07 2100-Thermal Insulation and drawings.

2.4 STRUCTURAL-STEEL FRAMING

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse and lean-to frames; rafter, rake, and canopy beams; sidewall, intermediate, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

   a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Architect.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.
3. Frame Configuration: Single gable.
4. Exterior Column Type: Tapered.
5. Rafter Type: Tapered.

B. End-Wall Framing: As shown on drawings for partial walls on open gable ends.

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates.

C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate

framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch- wide flanges.

    a. Depth: As needed to comply with system performance requirements.

2. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch- wide flanges.

    a. Depth: As indicated on drawings.

3. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
4. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch-diameter, cold-formed structural tubing to stiffen primary-frame flanges.
5. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
6. Base or Sill Angles: Minimum 3-by-2-inch zinc-coated (galvanized) steel sheet.
7. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet.
8. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from structural-steel sheet.
9. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
10. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

D. Bracing: Provide adjustable wind bracing as follows:

1. Rod X - Bracing; of size required to withstand design loads.

E. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted.

F. Materials:

1. W-Shapes: ASTM A 992/A 992M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
3. Plate and Bar: ASTM A 36/A 36M; ASTM A 572/A 572M, Grade 50 or 55; or ASTM A 529/A 529M, Grade 50 or 55.
4. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
5. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or C, structural tubing.

6. Structural-Steel Sheet: Hot-rolled, ASTM A 1011/A 1011M, Structural Steel (SS), Grades 30 through 55, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70; or cold-rolled, ASTM A 1008/A 1008M, Structural Steel (SS), Grades 25 through 80, or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70.

7. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers.

    a. Finish: Plain.

8. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts; ASTM A 563 heavy-hex carbon-steel nuts; and ASTM F 436 hardened carbon-steel washers, plain.

9. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

G. Finish: Factory primed. Apply specified primer immediately after cleaning and pretreating.

1. Apply primer to primary and secondary framing to a minimum dry film thickness of 1 mil.

    a. Prime secondary framing formed from uncoated steel sheet to a minimum dry film thickness of 0.5 mil on each side.

2. Primer: SSPC-Paint 15, Type I, red oxide.

2.5 METAL ROOF PANELS

1. See Section 07 4213-Metal Roof and Wall Panels.

2.6 METAL WALL PANELS

1. See Section 07 4213-Metal Roof and Wall Panels.

2.7 THERMAL INSULATION

1. See Section 07 2100-Thermal Insulation.

2.8 Overhead Doors

1. See Section 08 3323-Overhead Coiling Doors.

2. See Section 08 3613-Sectional Doors.

2.9 DOORS AND FRAMES

1. See Section 08-4313-Aluminum-Framed Storefronts.

2.10 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

   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.

B. Roof Curbs: Fabricated from minimum 0.052-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match metal roof panels; with welded top box and bottom skirt, and integral full-length cricket; capable of withstanding loads of size and height indicated.

   1. Curb Subframing: Fabricated from 0.064-inch nominal-thickness, angle-, C-, or Z-shaped metallic-coated steel sheet.
   2. Insulation: 1-inch- thick, rigid type.

C. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

D. Materials:

   1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.

      a. Fasteners for Metal Roof Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws, with a stainless-steel cap or zinc-aluminum-alloy head and EPDM sealing washer.
      b. Fasteners for Metal Roof Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head, with EPDM washer under heads of fasteners bearing on weather side of metal panels.
      c. Fasteners for Metal Wall Panels: Self-drilling or self-tapping, zinc-plated, hex-head carbon-steel screws[, with EPDM sealing washers bearing on weather side of metal panels].
      d. Fasteners for Metal Wall Panels: Self-drilling, Type 410 stainless-steel or self-tapping, Type 304 stainless-steel or zinc-alloy-steel hex washer head[, with EPDM sealing washers bearing on weather side of metal panels].
      e. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
      f. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Corrosion-Resistant 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.
3. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.
4. Metal Panel Sealants:

    a. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene-compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape of manufacturer's standard size.
    b. Joint Sealant: ASTM C 920; one-part elastomeric polyurethane or polysulfide; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended by metal building system manufacturer.

2.11 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate product.

B. Testing: Test and inspect shop connections for metal buildings according to the following:

1. Bolted Connections: Shop-bolted connections shall be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector'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 will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

C. Product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

2.12 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.
2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.
3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.
4. Weld clips to frames for attaching secondary framing.
5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.
2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with erector present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before erection proceeds, survey elevations and locations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments to receive structural framing, with erector present, for compliance with requirements and metal building system manufacturer's tolerances.

1. Engage land surveyor to perform surveying.

C. Proceed with erection only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition.

B. Provide temporary shores, guys, braces, and other supports during erection to keep structural framing secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural framing, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION OF STRUCTURAL FRAMING

A. Erect metal building system according to manufacturer's written erection instructions and erection drawings.

B. Do not field cut, drill, or alter structural members without written approval from metal building system manufacturer's professional engineer.

C. Set structural framing accurately in locations and to elevations indicated, according to AISC specifications referenced in this Section. Maintain structural stability of frame during erection.

D. Base 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. 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.
   3. 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.

E. Align and adjust structural framing before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with framing. 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 will be completed and in service.

F. Primary Framing and End Walls: Erect framing level, plumb, rigid, secure, and true to line. Level baseplates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use grout to obtain uniform bearing and to maintain a level base-line elevation. Moist-cure grout for not less than seven days after placement.

1. Make field connections using high-strength bolts installed according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for bolt type and joint type specified.

    a. Joint Type: Snug tightened.

G. Secondary Framing: Erect framing level, plumb, rigid, secure, and true to line. Field bolt secondary framing to clips attached to primary framing.

1. Provide rake or gable purlins with tight-fitting closure channels and fasciae.
2. Locate and space wall girts to suit openings such as doors and windows.
3. Locate canopy framing as indicated.
4. Provide supplemental framing at entire perimeter of openings, including doors, windows, louvers, ventilators, and other penetrations of roof and walls.

H. Bracing: Install bracing in roof and sidewalls where indicated on erection drawings.

1. Tighten rod and cable bracing to avoid sag.
2. Locate interior end-bay bracing only where indicated.

I. Framing for Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to structural framing.

J. Erection Tolerances: Maintain erection tolerances of structural framing within AISC 303.

3.4 METAL PANEL INSTALLATION, GENERAL

A. Examination: Examine primary and secondary framing to verify that structural-panel support members and anchorages have been installed within alignment tolerances required by manufacturer.

1. Examine roughing-in for components and systems penetrating metal panels, to verify actual locations of penetrations relative to seams before metal panel installation.

B. General: Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Field cut metal panels as required for doors, windows, and other openings. Cut openings as small as possible, neatly to size required, and without damage to adjacent metal panel finishes.

    a. Field cutting of metal panels by torch is not permitted unless approved in writing by manufacturer.

2. Install metal panels perpendicular to structural supports unless otherwise indicated.
3. Flash and seal metal panels with weather closures at perimeter of openings and similar elements. Fasten with self-tapping screws.

4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Locate metal panel splices over, but not attached to, structural supports with end laps in alignment.
6. Lap metal flashing over metal panels to allow moisture to run over and off the material.

C. Lap-Seam Metal Panels: Install screw fasteners using power tools with controlled torque adjusted to compress EPDM washers tightly without damage to washers, screw threads, or metal panels. Install screws in predrilled holes.

1. Arrange and nest side-lap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply metal panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

E. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal panel assemblies. Provide types of gaskets, fillers, and sealants indicated; or, if not indicated, provide types recommended by metal panel manufacturer.

1. Seal metal panel end laps with double beads of tape or sealant the full width of panel. Seal side joints where recommended by metal panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."

3.5 METAL ROOF PANEL INSTALLATION

A. General: Provide metal roof panels of full length from eave to ridge unless otherwise indicated or restricted by shipping limitations.

1. Install ridge caps as metal roof panel work proceeds.
2. Flash and seal metal roof panels with weather closures at eaves and rakes. Fasten with self-tapping screws.

B. Standing-Seam Metal Roof Panels: Fasten metal roof panels to supports with concealed clips at each standing-seam joint, at location and spacing and with fasteners recommended by manufacturer.

1. Install clips to supports with self-drilling or self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Rigidly fasten eave end of metal roof panels and allow ridge end free movement due to thermal expansion and contraction. Predrill panels for fasteners.

5. Provide metal closures at peaks, rake edges, rake walls and each side of ridge caps.

C. Metal Fascia Panels: Align bottom of metal panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws. Flash and seal metal panels with weather closures where fasciae meet soffits, along lower panel edges, and at perimeter of all openings.

D. Metal Roof Panel Installation Tolerances: Shim and align metal roof panels 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.

3.6 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts, extending full height of building, unless otherwise indicated. Anchor metal wall panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Unless otherwise indicated, begin metal panel installation at corners with center of rib lined up with line of framing.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. When two rows of metal panels are required, lap panels 4 inches minimum.
4. When building height requires two rows of metal panels at gable ends, align lap of gable panels over metal wall panels at eave height.
5. Rigidly fasten base end of metal wall panels and allow eave end free movement due to thermal expansion and contraction. Predrill panels.
6. Flash and seal metal wall panels with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
7. Install screw fasteners in predrilled holes.
8. Install flashing and trim as metal wall panel work proceeds.
9. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated; or, if not indicated, as necessary for waterproofing.
10. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-drilling or self-tapping screws.
11. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

B. Metal Wall Panels: Install metal wall panels on exterior side of girts. Attach metal wall panels to supports with fasteners as recommended by manufacturer.

C. Installation Tolerances: Shim and align metal wall panels within installed tolerance of 1/4 inch in 20 feet, nonaccumulative, on level, plumb, and on location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 THERMAL INSULATION INSTALLATION

A. General: Install insulation concurrently with metal panel installation, in thickness indicated to cover entire surface, according to manufacturer's written instructions.

1. Set vapor-retarder-faced units with vapor retarder toward warm side of construction unless otherwise indicated. Do not obstruct ventilation spaces except for firestopping.
2. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to the surrounding construction to ensure airtight installation.
3. Install factory-laminated, vapor-retarder-faced blankets straight and true in one-piece lengths, with both sets of facing tabs sealed, to provide a complete vapor retarder.
4. Install blankets straight and true in one-piece lengths. Install vapor retarder over insulation, with both sets of facing tabs sealed, to provide a complete vapor retarder.

B. Blanket Roof Insulation: Comply with the following installation method:

1. Two-Layers-between-Purlin-with-Spacer-Block Installation: Extend insulation between purlins. Install layer of filler insulation over first layer to fill space between purlins formed by thermal spacer blocks. Hold in place with bands and crossbands below insulation.

   a. Thermal Spacer Blocks: Where metal roof panels attach directly to purlins, install thermal spacer blocks.

2. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place as necessary. Install perforated fabric liner over interior side of purlins.

C. Wall Insulation: Fill voids between wall girts, metal wall panel and interior finish fully. See drawings for location of wall board, plywood, or perforated fabric liner. Apply thermal tape to exterior side of wall girts to provide thermal break between metal wall panels and girts.

1. Retainer Strips: Install retainer strips at each longitudinal insulation joint, straight and taut, nesting with secondary framing to hold insulation in place.

3.8 ACCESSORY INSTALLATION

A. General: 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 roof panel assembly, including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
2. Install components for a complete metal wall panel assembly, including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.
3. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with corrosion-resistant coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturer.

B. 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 will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil-canning, 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 result in waterproof and weather-resistant 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 or bayonet-type expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

C. Roof Curbs: Install curbs at locations indicated on Drawings. Install flashing around bases where they meet metal roof panels.

D. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to panel as recommended by manufacturer.

3.9 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Inspection of fabricators.
2. Steel construction.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Tests and Inspections:

1. High-Strength, Field-Bolted Connections: Connections shall be[**tested and**] inspected during installation according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
2. Welded Connections: In addition to visual inspection, field-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector'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 will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

D. Product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 CLEANING AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After erection, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted structural framing, bearing plates, and accessories.

1. Clean and prepare surfaces by SSPC-SP 2, "Hand Tool Cleaning," or by SSPC-SP 3, "Power Tool Cleaning."
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Metal Panels: Remove temporary protective coverings and strippable films, if any, as metal panels are installed. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

1. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 133419

SECTION 210517
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

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. Sleeves.
2. Stack-sleeve fittings.
3. Sleeve-seal systems.
4. Sleeve-seal fittings.
5. Grout.
6. Silicone sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

B. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anticorrosion coated, with plain ends and integral welded waterstop collar.

C. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

D. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.2 STACK-SLEEVE FITTINGS

A. Manufacturers: Jay R. Smith, Mfg., Zurn Products, or approved equal.

B. Description: Manufactured, Dura-coated or Duco-coated cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Advance Products & Systems, CALPICO, Inc., MatraFlex Company, or approved equal.

B. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20 psig minimum.
3. Sealing Elements: EPDM-rubber, High-temperature-silicone, or Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Carbon steel, Composite plastic, Stainless steel, or Stainless steel, Type 316.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 Stainless steel, Stainless steel, Type 316, as appropriate, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

A. Manufacturers: Advance Products & Systems, CALPICO, Inc., MatraFlex Company, or approved equal.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Plastic or rubber waterstop collar with center opening to match piping OD.

2.5 GROUT

A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Dow Corning Corporation, GE Construction Sealants, Polymeric Systems, Inc or approved equal.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

1. Manufacturer: May National Associates or approved equal.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

1. Manufacturers: Smooth-on or approved equal.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout or silicone sealant as appropriate, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Use silicone sealant to seal around the outside of stack-sleeve fittings.

B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Use grout or silicone sealant as appropriate, to seal the space around outside of sleeve-seal fittings.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves
   b. Piping NPS 6 and Larger: Steel pipe sleeves

2. Exterior Concrete Walls below Grade:
   a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:
   a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.
      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Steel pipe sleeves.

5. Interior Partitions:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

END OF SECTION

SECTION 21 05 18
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING GENERAL

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. Escutcheons.
2. Floor plates.

1.3 DEFINITIONS

A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: BrassCraft Manufacturing, Dearborn Brass, Jones Stephens Corp, Keeney Manufacturing Corp. or approved equal.

2.2 ESCUTCHEONS

A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.

C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.

E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.

F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

2.3 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping and Relocated Existing Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
   b. Insulated Piping: One-piece steel with polished, chrome-plated finish.
   c. Insulated Piping: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece steel with polished, chrome-plated finish.
   g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   h. Bare Piping in Unfinished Service Spaces: One-piece steel with polished, chrome-plated finish.
   i. Bare Piping in Unfinished Service Spaces: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
   j. Bare Piping in Equipment Rooms: One-piece steel with polished, chrome-plated finish.
   k. Bare Piping in Equipment Rooms: One-piece stamped steel or split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.

2. Escutcheons for Existing Piping to Remain: NOT USED

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping : One-piece, floor plate.
2. Existing Piping: Not Used

3.2 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 21 05 23
GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING

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. Two-piece ball valves with indicators.
2. Bronze butterfly valves with indicators.
3. Iron butterfly valves with indicators.
4. Check valves.
5. Bronze OS&Y gate valves.
6. Iron OS&Y gate valves.
7. NRS gate valves.
8. Trim and drain valves.

1.3 DEFINITIONS

A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

B. NRS: Non-rising stem.

C. OS&Y: Outside screw and yoke.

D. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, and weld ends.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

D. Protect flanges and specialties from moisture and dirt.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:

1. Main Level: HAMV - Fire Main Equipment.

   a. Level 1: HCBZ - Indicator Posts, Gate Valve.
   b. Level 1: HLOT - Valves.

      1) Level 3: HLUG - Ball Valves, System Control.
      2) Level 3: HLXS - Butterfly Valves.
      3) Level 3: HMER - Check Valves.
      4) Level 3: HMRZ - Gate Valves.

2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.

   a. Level 1: VQGU - Valves, Trim and Drain.

B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:

1. Automated Sprinkler Systems:
   a. Valves.

      1) Gate valves.
      2) Check valves.
      3) Miscellaneous valves.

C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.

D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads for threaded-end valves.
3. ASME B31.9 for building services piping valves.

E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

F. NFPA Compliance: Comply with NFPA 24 for valves.

G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.

H. Valve Sizes: Same as upstream piping unless otherwise indicated.

I. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.2 TWO-PIECE BALL VALVES WITH INDICATORS

A. Manufacturers: Ames Fire & Waterworks, NIBCO, Inc. Victaulic Company or approved equal.

B. Description:

1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
2. Minimum Pressure Rating: 175 psig.
3. Body Design: Two piece.
4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear or traveling nut.
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Fivalco Inc., Globe Fire Sprinkler Corp., Miluakee Valve Company or approved equal.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
2. Minimum: Pressure rating: 175 psig.
3. Body Material: Bronze.
4. Seat Material: EPDM.
5. Stem Material: Bronze or stainless steel.
6. Disc: Stainless steel.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Manufacturers: Anvil International, Fivalco Inc., Globe Fire Sprinkler Corp., NIBCO Inc., or approved equal.

B. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Grooved-end connections.

2.5 CHECK VALVES

A. Manufacturers: Ames Fire & Waterworks, Anvil International, NIBCO Inc., Fivalco Inc. Globe Fire Sprinkler Corp. or approved equal

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.6 BRONZE OS&Y GATE VALVES

A. Manufacturers: Milwuakee Valve Company, NIBCO Inc., Zurn Industries, LLC or approved equal.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Threaded.

2.7 IRON OS&Y GATE VALVES

A. Manufacturers: American Cast Iron Pipe Company, Kennedy Valve Company, NIBCO Inc. or approved equal

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.8 NRS GATE VALVES

A. Manufacturers: American Cast Iron Pipe Company, Kennedy Valve Company, NIBCO Inc. or approved equal.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged or Grooved.

2.9 INDICATOR POSTS – NOT APPLICABLE

2.10 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: NIBCO Inc., Potter Roemer, LLC., Tyco Fire Products LP or approved equal.

2. Description:

a. Pressure Rating: 175 psig.
b. Body Design: Two piece.
c. Body Material: Forged brass or bronze.
d. Port size: Full or standard.
e. Seats: PTFE.
f. Stem: Bronze or stainless steel.
g. Ball: Chrome-plated brass.
h. Actuator: Handlever.
i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

B. Angle Valves:

1. Manufacturers: Fire Protection Products, NIBCO INC., United Brass Works, Inc.

2. Description:

a. Pressure Rating: 175 psig
b. Body Material: Brass or bronze.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc: Bronze.
f. Packing: Asbestos free.
g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Manufacturers: NIBCO INC., United Brass Works, Inc. or approved equal
2. Description:

a. Pressure Rating: 175 psig
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

A. Comply with requirements in the following Sections for specific valve installation requirements and applications:

1. Section 211100 "Facility Fire-Suppression Water-Service Piping" for application of valves in fire-suppression water-service piping outside the building.
2. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.

E. Install valves in horizontal piping with stem at or above the pipe center.

F. Install valves in position to allow full stem movement.

G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.

I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION

SECTION 21 05 29
HANGERS AND SUPPORTS FOR FIRE SUPRESSION PIPING AND EQUIPMENT

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 pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal hanger-shield inserts.
5. Fastener systems.
6. Equipment supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers 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 trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for fire-suppression piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

C. NFPA Compliance: Comply with NFPA 13.

D. UL Compliance: Comply with UL 203.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: Factory-fabricated components, NFPA approved, UL listed, or FM approved for fire-suppression piping support.
2. Galvanized Metallic Coatings: Pregalvanized or hot-dip galvanized.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

B. Copper Pipe and Tube Hangers: NOT USED

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with NFPA-approved, UL-listed, or FM-approved carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems: Not Used

B. Non-MFMA Manufacturer Metal Framing Systems: Not used

2.5 THERMAL HANGER-SHIELD INSERTS

A. Not used

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: NFPA-approved, UL-listed, or FM-approved threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Hilti, Inc. ITW Ramset / Red Head or approved equal

B. Mechanical-Expansion Anchors: NFPA-approved, UL-listed, or FM-approved, insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Hilti, Inc. ITW Ramset / Red Head, or approved equal/
2. Indoor Applications: Stainless steel.
3. Outdoor Applications: Stainless steel.

2.7 EQUIPMENT SUPPORTS

A. Description: NFPA-approved, UL-listed, or FM-approved, welded, shop- or field-fabricated equipment support, made from structural-carbon-steel shapes.

2.8 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout, suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum

static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with installation requirements of approvals and listings. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal strut systems.

D. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Install in accordance with approvals and listings.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. Install in accordance with approvals and listings.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping: Not Used

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING – Not Used

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with NFPA requirements for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.

G. Not used

H. Not used

I. Horizontal-Piping Hangers and Supports: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 .
2. Steel Pipe Clamps (MSS Type 4): For suspension of NPS 1/2 to NPS 24 if little or no insulation is required.
3. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
4. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
5. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
6. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
7. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
8. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Comply with NFPA requirements.

L. Building Attachments: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. C-Clamps (MSS Type 23): For structural shapes.
3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.

M. Saddles and Shields: Comply with NFPA requirements. Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

N. Comply with NFPA requirements for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 21 05 53
IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

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. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

D. Valve Schedules: Valve numbering scheme.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032 inch stainless steel, 0.025 inch aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: Black, Red or White.
3. Background Color: Black, Red or White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for

greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch or 1/8 inch thick, with predrilled holes for attachment hardware.
2. Letter Color: Black, Red or White.
3. Background Color: Black, Red or White
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch or 1/8 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: Black, Red or White

C. Background Color: Black, Red or White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

E. Pipe-Label Colors:

1. Background Color: Safety Red.
2. Letter Color: White.

2.4 STENCILS

A. Stencils for Piping:

1. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
2. Stencil Material: Aluminum, brass or other metal.
3. Stencil Paint: Safety Red, exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.
4. Identification Paint: White, exterior, acrylic enamel. Paint may be in pressurized spray-can form.

2.5 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032 inch, stainless steel, 0.025 inch or aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain or S-hook.
3. Valve-Tag Color: Safety Red.
4. Letter Color: White.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Description: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Safety Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping: Painting of piping is specified in Section 099123 "Interior Painting."

B. Stenciled Pipe-Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on [both sides of]through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of [50 feet along each run. Reduce intervals to [25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes including pipes where flow is allowed in both directions.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape:
   a. Wet-Pipe Sprinkler System: 1-1/2 inches.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 21 10 00
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

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 fire-suppression water-service piping and related components outside the building and service entrance piping through floor into the building and the following:

1. Pipes, fittings, and specialties.
2. Fire-suppression specialty valves.
3. Concrete vaults.
4. Protective enclosures.
5. Alarm devices.

B. Utility-furnished products include water meters that are furnished to the site, ready for installation.

C. Related Requirements:
1. Section 211119 "Fire-Department Connections" flush-type fire department connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:

1. Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.

B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

C. 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.

D. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.

E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:

1. Ensure that valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flange faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, annealed temper.

B. Hard Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L, water tube, drawn temper.

C. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

D. Copper, Pressure-Seal Fittings:
1. Standard: UL 213.
2. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
3. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.

F. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.

B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.

C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.

D. Grooved-End, Ductile-Iron Pipe Appurtenances:

1. Manufacturers: Anvil International, Tyco Fire Products, LP, Victaulic Company or approved equal.
2. Grooved-End, Ductile-Iron Fittings: ASTM A 47/A 47M, malleable-iron castings or ASTM A 536, ductile-iron castings with dimensions matching pipe.
3. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.

1. Gaskets: AWWA C111, rubber.

G. Flanges: ASME B16.1, Class 125, cast iron.

2.3 PE PIPE AND FITTINGS

A. PE, Fire-Service Pipe: FM Global approved, with minimum thickness equivalent to Class 150.

B. Molded PE Fittings: FM Global approved; PE butt-fusion type, made to match PE pipe dimensions and class.

2.4 PVC PIPE AND FITTINGS

A. PVC Pipe: UL 1285, Class 150 and Class 200, with bell end with gasket, and with spigot end.

B. PVC Fittings: UL 1285, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.5 FIBERGLASS PIPE AND FITTINGS – Not Used

2.6 SPECIAL PIPE FITTINGS

A. Ductile-Iron Flexible Expansion Joints:

1. Manufacturers: Romac Industries, Star Pipe Products, or approved equal.
2. Description: Compound, ductile-iron fitting with combination of flanged and mechanical-joint ends complying with AWWA C110 or AWWA C153. Include two gasketed ball-joint sections and one or more gasketed sleeve sections. Assemble components for offset and expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
3. Pressure Rating: 250 psig minimum.

B. Ductile-Iron Deflection Fittings:
1. Description: Compound, ductile-iron coupling fitting with sleeve and one or two flexing sections for up to 15-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
2. Pressure Rating: 250 psig minimum.

2.7 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Material: Linear low-density PE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.

C. Form: Sheet or tube

D. Color: Black or Natural.

2.8 JOINING MATERIALS

A. Gaskets for Ferrous Piping and Copper-Alloy Tubing: ASME B16.21, asbestos free.

B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series.

C. Bonding Adhesive for Fiberglass Piping: As recommended by fiberglass piping manufacturer.

2.9 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:
   1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners, and with ends of same sizes as piping to be joined.
   2. Standard: AWWA C219.
   3. Center-Sleeve Material: Manufacturer's standard, carbon steel, stainless steel, or ductile iron
   4. Gasket Material: Natural or synthetic rubber.
   5. Pressure Rating: 150 psig minimum.
   6. Metal Component Finish: Corrosion-resistant coating or material.

2.10 CORPORATION VALVES – Not Used.

2.11 CURB VALVES

A. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.

B. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.

   1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

C. Meter Valves: Comply with AWWA C800 for high-pressure, service-line valves. Include angle- or straight-through-pattern bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.

2.12 DETECTOR CHECK VALVES

A. Manufacturers: Ames Fire & Waterworks, Watts, Zurn Industries or approved equal.

B. Description: Galvanized cast-iron body, bolted cover with air-bleed device for access to internal parts, and flanged ends. Include one-piece bronze disc with bronze bushings, pivot, and replaceable seat. Include threaded bypass taps in inlet and outlet for bypass meter connection. Set valve to allow minimal water flow through bypass meter when major water flow is required.

C. Standards: UL 312 and FM Global's "Approval Guide."

D. Pressure Rating: 175 psig

E. Water Meter: AWWA C700, disc type, at least one-fourth size of detector check valve. Include meter, bypass piping, gate valves, check valve, and connections to detector check valve.

2.13 WATER METERS

A. Water meters are furnished by utility company.

B. Manufacturers: Watts, Neptune or Approved equal.

C. Displacement-Type Water Meters:

1. Description: With bronze main case.
2. Standard: AWWA C700.
3. Registration: Flow in gallons

D. Turbine-Type Water Meters:

1. Standard: AWWA C701.
2. Registration: Flow in gallons

E. Compound-Type Water Meters:

1. Standard: AWWA C702.
2. Registration: Flow in gallons

F. Remote Registration System:

1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C706.
3. Registration: Flow in gallons

G. Remote Registration System:

1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C707.
3. Registration: Flow in gallons
4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.14 DETECTOR-TYPE WATER METERS

A. AWWA, Detector Check Water Meters:

1. Description: Main line, turbine meter with second meter on bypass.
2. Standard: AWWA C703.
3. Registration: Flow in gallons

4. Pressure Rating: 150 psig
5. Bypass Meter: AWWA C701, turbine type, bronze case.

    a. Size: At least one-half nominal size of main-line meter.

B. Fire-Protection, Detector Check Water Meters:

1. Description: Main-line turbine meter with strainer and second meter on bypass.
2. Standards: UL's "Fire Protection Equipment Directory" listing and FM Global's "Approval Guide."
3. Registration: Flow in gallons
4. Pressure Rating: 175 psig minimum.
5. Bypass Meter: AWWA C701, turbine-type, bronze case.

    a. Size: At least NPS 2

C. Remote Registration System:

1. Description: Utility company's standard; direct-reading type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C706.
3. Registration: Flow in gallons

D. Remote Registration System:

1. Description: Utility company's standard; encoder type. Include meter modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly.
2. Standard: AWWA C707.
3. Registration: Flow in gallons
4. Data-Acquisition Units: Comply with utility company's requirements for type and quantity.
5. Visible Display Units: Comply with utility company's requirements for type and quantity.

2.15 PRESSURE-REDUCING VALVES – Not used

2.16 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers – Not used

B. Double-Check, Backflow-Prevention Assemblies:
1. Standard: ASSE 1015 or AWWA C510.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
4. Size: 6”
5. Design Flow Rate:
6. Selected Unit Flow Range Limits:
7. Pressure Loss at Design Flow Rate:
8. Body Material: Steel with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
9. End Connections: Flanged for NPS 2-1/2 and larger.
10. Configuration: Designed for horizontal, straight through flow.
11. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies: - Not Used

D. Double-Check, Detector-Assembly Backflow Preventers: Not Used

E. Backflow Preventer Test Kits:
   1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.17 WATER METER BOXES

A. Description: Cast-iron body and double cover for disc-type water meter, with lettering "WATER METER" on top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

2.18 CONCRETE VAULTS

A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857, and made according to ASTM C 858.

B. Ladder: ASTM A 36/A 36M, steel ladder; or PE-encased steel steps.

C. Manhole: ASTM A 48/A 48M, Class No. 35A minimum tensile strength, gray-iron traffic frame and cover.

   1. Dimension: 24-inch (610-mm) minimum diameter unless otherwise indicated.

D. Drain: ASME A112.6.3, cast-iron floor drain with outlet of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

2.19 PROTECTIVE ENCLOSURES

A. Freeze-Protection Enclosures:
   1. Description: Insulated enclosure designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F when external temperatures reach as low as minus 34 deg F
   2. Standard: ASSE 1060.
   3. Class I: For equipment or devices other than pressure or atmospheric vacuum breakers.

      a. Housing: Reinforced aluminum or fiberglass construction.

         1) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
         2) Drain opening for units with drain connection.
         3) Access doors with locking devices.
         4) Insulation inside housing.
         5) Anchoring devices for attaching housing to concrete base.

      b. Electric heating cable or heater with self-limiting temperature control.

B. Weather-Resistant Enclosures:
   1. Description: Uninsulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage.
   2. Standard: ASSE 1060.
   3. Class III: For equipment or devices other than pressure or atmospheric vacuum breakers.
   4. Class III-V: For pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

      a. Housing: Reinforced aluminum or fiberglass construction.

         1) Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
         2) Drain opening for units with drain connection.
         3) Access doors with locking devices.
         4) Anchoring devices for attaching housing to concrete base.

C. Expanded-Metal Enclosures:
   1. Description: Enclosure designed to protect aboveground water piping, equipment, or specialties from damage.
   2. Material: ASTM F 1267, expanded-metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.
   3. Type: I, expanded or II, expanded and flattened].
   4. Class: 1, uncoated carbon steel, 2, hot-dip, zinc-coated carbon steel or 3, corrosion-resistant steel.
   5. Finish: Manufacturer's enamel paint.
   6. Size: Of dimensions indicated, but not less than those required for access and service of protected unit.
   7. Locking device.
   8. Lugs or devices for securing enclosure to base.
   9. Enclosure Bases: 4-inch- minimum thickness precast concrete, of dimensions required to extend at least 6 inches beyond edges of enclosure housings. Include openings for piping.

2.20 ALARM DEVICES

A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.

B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.

C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with excavating, trenching, and backfilling requirements in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.

B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.

C. Make connections larger than NPS 2 with tapping machine according to the following:

1. Install tapping sleeve and tapping valve according to MSS SP-60.
2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.

D. Make connections NPS 2 and smaller with drilling machine according to the following: Not Used

E. Comply with NFPA 24 for fire-service-main piping materials and installation.

F. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

G. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.

1. Install encasement for piping according to ASTM A 674 or AWWA C105.

H. Install PE pipe according to ASTM D 2774 and ASTM F 645.

I. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.

J. Install fiberglass AWWA pipe according to AWWA M45.

K. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:

1. Under Driveways: With at least 36 inches of cover over top.
2. Under Railroad Tracks: Not Used
3. In Loose Gravelly Soil and Rock: With at least 12 inches of additional cover.

L. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.

M. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.

1. Terminate fire-suppression water-service piping within the building at the floor slab until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.

N. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

O. Comply with requirements for fire-suppression water-service piping inside the building in the following Sections:

1. Section 211200 "Fire-Suppression Standpipes"
2. Section 211313 "Wet-Pipe Sprinkler Systems

P. Comply with requirements in Section 221116 "Domestic Water Piping" for potable-water piping inside the building.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.3 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in tubing NPS 2 and smaller.

C. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2and larger end connections.

D. Ream ends of tubes and remove burrs.

E. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.

F. Copper-Tubing, Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

G. Copper-Tubing, Pressure-Sealed Joints: Use proprietary crimping tool and procedure recommended by copper, pressure-seal-fitting manufacturer.

H. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

I. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.

J. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.

K. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

L. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139.

M. Fiberglass Piping Bonded Joints: Use adhesive and procedure recommended by piping manufacturer.

N. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.

O. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:

1. Concrete thrust blocks.
2. Locking mechanical joints.
3. Set-screw mechanical retainer glands.
4. Bolted flanged joints.
5. Heat-fused joints.
6. Pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches in fire-suppression water-service piping according to NFPA 24 and the following:

1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.

B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.

C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.

E. MSS Valves: Install as component of connected piping system.

F. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

G. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves. Install full-size valved bypass.

3.6 DETECTOR CHECK VALVE INSTALLATION

A. Install in vault or aboveground.

B. Install for proper direction of flow. Install bypass with water meter, gate valves on each side of meter, and check valve downstream from meter.

3.7 WATER METER INSTALLATION

A. Install water meters, piping, and specialties according to utility company's written instructions.

B. Water Meters: Install detector-type water meters in meter vault according to AWWA M6. Include shutoff valves on water meter inlets and outlets and include full-size valved bypass around meters. Support meters, valves, and piping on brick or concrete piers.

3.8 ROUGHING-IN FOR WATER METERS

A. Rough-in piping and specialties for water meter installation according to utility company's written instructions.

3.9 BACKFLOW PREVENTER INSTALLATION

A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow preventers.

3.10 WATER METER BOX INSTALLATION

A. Install water meter boxes in paved areas flush with surface.

B. Install water meter boxes in grass or earth areas with top 2 inches above surface.

3.11 CONCRETE VAULT INSTALLATION

A. Install precast concrete vaults according to ASTM C 891.

3.12 PROTECTIVE ENCLOSURE INSTALLATION

A. Install concrete base level and with top approximately 2 inches above grade.

B. Install protective enclosure over valves and equipment.

C. Anchor protective enclosure to concrete base.

3.13 FIRE-DEPARTMENT CONNECTION INSTALLATION

A. Install ball drip valves at each check valve for fire-department connection to mains.

B. Install protective pipe bollards on two sides of each freestanding fire-department connection. Pipe bollards are specified in Section 055000 "Metal Fabrications."

3.14 ALARM DEVICE INSTALLATION - See 221313

3.15 CONNECTIONS

A. Connect fire-suppression water-service piping to utility water main. Use tapping sleeve and tapping valve.

B. Connect fire-suppression water-service piping to interior fire-suppression piping.

C. Connect waste piping from concrete vault drains to sanitary sewerage system.

3.16 FIELD QUALITY CONTROL

A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.

B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare test and inspection reports.

3.17 IDENTIFICATION

A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.18 CLEANING

A. Clean fire-suppression water-service piping as follows:

1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
    b. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    c. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports of purging and disinfecting activities.

3.19 PIPING SCHEDULE

A. Underground fire-suppression water-service piping NPS 4 (DN 100) shall be one of the following:
1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
3. Push-on-joint, ductile-iron pipe; push-on-joint, ductile-iron compact-pattern fittings; and gasketed joints.

3.20 VALVE SCHEDULE

A. Underground fire-suppression water-service shutoff valves NPS 3 and larger shall be one of the following:

1. 200-psig (1380-kPa), AWWA, iron, nonrising-stem, metal-seated gate valves.
2. 250-psig (1725-kPa), AWWA, iron, nonrising-stem, resilient-seated gate valves.
3. 175-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves.

B. Indicator-post underground fire-suppression water-service valves NPS 3 (DN 80) and larger shall be 175-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.

C. Standard-pressure, aboveground fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be the following:
1. 175-psig, UL-listed or FM Global-approved, iron, OS&Y gate valves.

D. Fire-suppression water-service check valves NPS 3 and larger shall be one of the following:

1. AWWA or UL-listed or FM Global-approved check valves.
2. UL-listed or FM Global-approved detector check valves.

END OF SECTION

SECTION 21 11 19
FIRE DEPARTMENT CONNECTIONS

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. Exposed-type fire-department connections.
2. Flush-type fire-department connections.
3. Yard-type fire-department connections.

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 fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION – NOT USED

2.2 FLUSH-TYPE FIRE-DEPARTMENT CONNECTION – NOT USED

2.3 YARD-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Elkhart Brass Mfg., Fire-End & Croker Corporation or approved equal

B. Standard: UL 405.

C. Type: Exposed, freestanding.

D. Pressure Rating: 175 psig (1200 kPa) minimum

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, floor type.

I. Outlet: Bottom, with pipe threads.

J. Number of Inlets: Single Storz, 5”

K. Sleeve: Brass

L. Sleeve Height: 18 inches (460 mm).

M. Escutcheon Plate Marking: Similar to AUTO SPKR

N. Finish, Including Sleeve: Rough brass or bronze

O. Outlet Size: NPS 4 (DN 100)

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 fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Existing wall-type fire-department connections shall be utilized; replace or repair as needed and provide additional fire-department connections at discretion of fire department.

B. Install two protective pipe bollards around each fire-department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

C. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION

SECTION 21 13 13
WET-PIPE SPRINKLER 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. Section Includes:

1. Pipes, fittings, and specialties.
2. Cover system for sprinkler piping.
3. Specialty valves.
4. Sprinklers.
5. Alarm devices.
6. Manual control stations.
7. Control panels.
8. Pressure gages.

B. Related Requirements:

1. Section 211119 "Fire Department Connections" for yard-type fire department connections.
2. Section 230523 "General-Duty Valves for Water-Based Fire-Suppression Piping" for ball, butterfly, check, gate, post-indicator, and trim and drain valves.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig (1200-kPa) maximum.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals: Not Used

C. Shop Drawings: For wet-pipe sprinkler systems.

1. Include plans, elevations, sections, and attachment details.
2. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Domestic water piping.
2. Compressed air piping.
3. HVAC hydronic piping.
4. Items penetrating finished ceiling include the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers / Announcement System
    d. Fire Alarm System

B. Qualification Data: For qualified Installer.

C. Design Data:

1. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Field Test Reports:

1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
2. Fire-hydrant flow test report.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems. Base calculations on results of fire-hydrant flow test.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of sprinkler service.
2. Do not proceed with interruption of sprinkler service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13.

B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

C. Delegated Design: Not Used.

1. Available fire-hydrant flow test records indicate the following conditions:
   a. Time: N.A
   b. Performed by: Paramount Engineering
   c. Static Pressure at Residual Fire Hydrant R: 45 psi
   d. Measured Flow at Flow Fire Hydrant F: 23 psi
   e. Residual Pressure at Residual Fire Hydrant R: 692 gpm

2. Sprinkler system design shall be approved by authorities having jurisdiction.

   a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   b. Sprinkler Occupancy Hazard Classifications:
      1) All Areas (except noted below in #2/#3): Light Hazard
      2) Mechanical, Electrical, Janitor, Riser: Ordinary Hazard Group 1
      3) Construction Trades: Ordinary Hazard Group 2

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft.

b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft.
c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft.

4. Minimum Density for Deluge-Sprinkler Piping Design: Not Used

5. Maximum Protection Area per Sprinkler: According to UL listing.
6. Maximum Protection Area per Sprinkler:
   a. Light Hazard: 225 sq. ft.
   b. Ordinary Hazard Group 1: 130 sq. ft.
   c. Ordinary Hazard Group 2: 130 sq. ft.

D. Seismic Performance: Not anticipated; confirm with structural drawings and specifications.

2.2 STEEL PIPE AND FITTINGS

A. Standard-Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Schedule 10, Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10 plain end.

E. Nonstandard OD, Thinwall Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M thinwall with plain ends and wall thickness less than Schedule 10.

F. Hybrid Black-Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5.

G. Schedule 5 Steel Pipe: ASTM A 135/A 135M or ASTM A 795/A 795M lightwall with plain ends.

H. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

I. Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

J. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

K. Malleable- or Ductile-Iron Unions: UL 860.

L. Cast-Iron Flanges: ASME 16.1, Class 125.

M. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8-inch-thick, ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.

a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.

2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

N. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

O. Grooved-Joint, Steel-Pipe Appurtenances:
1. Pressure Rating: 175-psig minimum.
2. Painted or uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

P. Steel Pressure-Seal Fittings: UL 213, FM Global-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

2.3 COPPER TUBE AND FITTINGS – NOT USED

2.4 CPVC PIPE AND FITTINGS- NOT USED

2.5 COVER SYSTEM FOR SPRINKLER PIPING – NOT USED

2.6 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:

1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Alarm Valves:
1. Standard: UL 193.
2. Design: For horizontal or vertical installation.
3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
5. 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.

G. Deluge Valves: Not Used

H. Automatic (Ball Drip) Drain Valves:
1. Standard: UL 1726.
2. Pressure Rating: 175-psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.7 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:

1. Manufacturers: ARGCO, Grinnell or approved equal
2. Standard: UL 213.
3. Pressure Rating: 175-psig minimum
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-tee and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: AGF Manufacturing, Inc. Reliable Automatic Sprinkler, Tyco Fire Products, LP or approved equal.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Branch Line Testers:

1. Manufacturers: AGF Manufacturing, Inc., Elkhart Brass Mfg. Co., Potter Electric Signal Co. or approved equal.
2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: AGF Manufacturing, Inc. Tyco Fire Products, LP. or approved equal.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.

6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: CECA, LLC., Merit Manufacturing, or approved equal.
2. Standard: UL 1474.
3. Pressure Rating: 250-psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Fivalco Inc., Victaulic Company or approved equal.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum
5. Size: Same as connected piping, for sprinkler.

2.8 SPRINKLERS

A. Manufacturers: Reliable Automatic Sprinkler, Tyco Fire Products, LP, Victaulic Company or approved equal.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: Not Used

D. Pressure Rating for Automatic Sprinklers: 175-psig

E. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: Not used
2. Nonresidential Applications: UL 199
3. Residential Applications: Not Used
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated. Construction Trades utilize k-8.0

F. Sprinkler Finishes: Brass and white concealed plates

G. Special Coatings: Not Used

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

I. Sprinkler Guards:
1. Standard: UL 199.

2. Type: Wire cage with fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Motor-Operated Alarm:

1. Manufacturers: Tyco Fire Products, LP, Victaulic Compay or approved equal
2. Standard: UL 753.
3. Type: Mechanically operated, with Pelton wheel.
4. Alarm Gong: Cast aluminum with red-enamel factory finish.
5. Size: 10 inch diameter.
6. Components: Shaft length, bearings, and sleeve to suit wall construction.
7. Inlet: NPS 3/4 (DN 20).
8. Outlet: NPS 1 (DN 25) drain connection.

C. Electrically Operated Alarm Bell:

1. Manufacturers: Potter Electric Signal Company, Notifier, or approved equal
2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum.
5. Finish: Red-enamel factory finish, suitable for outdoor use.
6. 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.

D. Water-Flow Indicators:

1. Manufacturers: Potter Electric Signal Co., Watts, Viking Corporation, and approved equal.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig
7. Design Installation: Horizontal or vertical.

E. Pressure Switches:

1. Manufacturers: Tyco Fire Products, LP, Potter Electric Signal Co. or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised water-flow switch with retard feature.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design Operation: Rising pressure signals water flow.

F. Valve Supervisory Switches:

1. Manufacturers: Tyco Fire Products, LP, Potter Electric Signal Co. or approved equal.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.

5. Design: Signals that controlled valve is in other than fully open position.
6. 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.

2.10 MANUAL CONTROL STATIONS

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide" for hydraulic operation, with union, NPS 1/2 pipe nipple, and bronze ball valve.

B. Include metal enclosure labeled "MANUAL CONTROL STATION," with operating instructions and cover held closed by breakable strut to prevent accidental opening.

2.11 CONTROL PANELS: Not Used

2.12 PRESSURE GAGES

A. Manufacturers: AGF Manufacturing, Inc., Ashcroft, Inc. or approved equal.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0- to 250-psig minimum.

E. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping. Comply with requirements for backflow preventers in Section 211100 "Facility Fire-Suppression Water-Service Piping."

3.3 WATER-SUPPLY CONNECTIONS

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.

   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
   2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal and install where they are not subject to freezing.

N. Fill sprinkler system piping with water.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

3.5 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

O. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

P. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

Q. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

R. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

S. Plastic-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

3.6 INSTALLATION OF COVER SYSTEM FOR SPRINKLER PIPING

A. Install cover system, brackets, and cover components for sprinkler piping according to manufacturer's "Installation Manual" and NFPA 13 or NFPA 13R for supports.

3.7 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. Install valves in vertical position for proper direction of flow, in main supply to system.
2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.8 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.9 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspection:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.13 PIPING SCHEDULE

A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends, grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Copper-tube, extruded-tee connections may be used for tee branches in copper tubing instead of specified copper fittings. Branch-connection joints must be brazed.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight black-steel pipe with cut- or roll- grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

E. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight black-steel pipe with cut or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Standard-weight black-steel pipe with plain ends; steel welding fittings; and welded joints.
5. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
6. Schedule 10 black-steel pipe with plain ends; welding fittings; and welded joints.

3.14 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers
2. Rooms with Suspended Ceilings: Concealed sprinklers
3. Wall Mounting: horizontal dry sidewalls
4. Spaces Subject to Freezing: horizontal dry sidewalls
5. Special Applications: quick-response sprinklers, horizontal dry sidewalls for exterior awning

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Not Used
3. Recessed Sprinklers: Not Used
4. Residential Sprinklers: Not Used
5. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
6. Dry Sidewall: Horizonal dry sidewall to protect exterior projection under awning.

END OF SECTION

SECTION 220000
GENERAL PLUMBING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Instructions to Bidders, General Conditions of the Contract, Supplementary General Conditions and Division 01 Specifications Sections bound herewith are a component part of Division 22 specifications. Comply with all provisions, details and instructions of these sections in the accomplishment of work covered under Division 23.

B. Furnish all labor, materials and equipment and incidentals required to make ready for use complete plumbing systems as shown on the Drawings and specified herein.

C. Where Sub-Contracts are used to perform portions of the work, division of labor between sub trades is the responsibility of the Contractor.

D. Furnish all labor, materials and equipment and incidentals required to make ready for use complete plumbing systems as shown on the Drawings and specified herein.

E. Work includes furnishing, installing and testing the equipment and materials specified in other sections of the Division Specifications and shown on the Plumbing Drawings. It is the intent of these Specifications that the plumbing systems shall be suitable in every way for the intended usage. All material and all work which may be reasonably implied as being incidental to the work of this Division shall be furnished at no extra cost.

F. The general scope work includes, but is not limited to, furnishing, coordinating, and installing the following.

1. Sanitary waste and vent systems with connection to site utilities.
2. Domestic water distribution systems with connection to site utilities.
3. Roof drainage systems with connections to site utilities.
4. Fuel gas piping with connection to site gas supply.
5. Plumbing fixtures, specialties and equipment.

G. Visit all areas of the existing site, buildings and structures (as applicable) in which work under these sections is to be performed. Inspect carefully the existing conditions prior to bidding. Bid submission is evidence that the Contractor has examined the site and existing conditions, understands conditions under which the work will be performed, and takes full responsibility for complete knowledge of all factors governing the work.

H. Schedule all service interruptions in existing facilities at the Owner's convenience with 24 hours (minimum) notice. Obtain prior approval for each interruption.

I. Thoroughly test all plumbing systems after installation and make any minor corrections, changes or adjustments necessary for proper functioning of the systems and equipment. All workmanship shall be of the highest quality; substandard work will be rejected.

1.02 SUBMITTALS

A. Procedures for submittals: Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 01 Specifications Sections.

Transmit each shop drawing submittal with provided Shop Drawing Submittal Cover Form, attached herewith for each item of equipment/material or each specification section/paragraph.

B. Clearly indicate proposed equipment and/or materials substitutions in shop drawings. Summarize all deviations from the specified quality, functionality, appearance or performance of proposed equipment and/or materials in the preface of each submittal. Include documentation to support deviations.

C. Provide descriptive data on all materials and equipment as required to ascertain compliance with Specifications.

D. Design layout shown on drawings is based on physical sizes of reputable equipment manufacturers. If equipment other than models indicated is installed, any resulting conflicts with space, maintenance access, clearances or codes are the responsibility of the Contractor to correct at his expense.

E. Where specific models and manufacturers of materials and equipment are specified, substitutions as allowed by the specifications and State law will be considered. Substitutions must be equivalent in quality, function, suitability and arrangement to specified equipment. Architect/Engineer to have final authority as to equivalency of substitutions.

F. Equipment model numbers noted in these specifications or on the drawings are intended to establish a minimum standard of quality and do not necessarily relate to specific options or arrangement as shown. Provide equipment with all standard features and optional features as stated and arranged as shown on the drawings.

G. Where seismic design for supports is required, submit installation details for supports and engineering analysis as specified.

1.03 REGULATORY REQUIREMENTS

A. Perform Work in accordance with all applicable state and local codes, standards and regulations.

B. Furnish all materials and labor which is be required for compliance with codes, standards and regulations, whether specifically mentioned in these specifications or shown on the drawings.

C. Obtain required construction permit from the authority having jurisdiction and arrange, at the proper time, for all inspections required by such authority. Pay all permit and inspection costs required.

1.04 COORDINATION OF WORK

A. Contractor is responsible for coordination of work between trades. Provide fully complete and functional systems.

B. Compare plumbing drawings and specifications with the drawings and specifications for other trades.

C. Coordinate plumbing installation with the work of other trades. Report any pertinent discrepancies to the Architect/Engineer and obtain written instructions for any necessary revisions. Before starting any construction, make proper provisions to avoid interferences in a manner approved by the Architect/Engineer. No extras will be allowed for rework of uncoordinated installations.

D. Determine exact route and location of each plumbing item prior to fabrication and/or installation. Adjust location of piping and equipment, etc., to accommodate interferences anticipated and encountered.

E. Right of Way: General priority for right of way is as follows:

1. Items located per regulatory requirement.
2. Piping with pitch requirement (plumbing drains, etc.).
3. Ductwork.
4. Piping without pitch requirement.
5. Electrical wiring (conduits, etc.).

F. Arrange all work to permit removal (without damage to other parts) of any equipment requiring periodic replacement.

G. Provide clearance and easy access to any equipment which requires periodic maintenance. Arrange ducts, piping and equipment to permit ready access to valves, cocks, traps, starters, motors, control components, etc., and to clear the opening of swinging doors and access panels.

1.05 EQUIPMENT AND MATERIALS (GENERAL)

A. Provide all new materials unless specifically indicated otherwise.

B. Manufacturers and models listed in drawings and specifications are used for layout and to convey to bidders the general style, type, character and quality of product desired. Listed examples are used only to denote the quality standard of product desired and are not intended to restrict bidders to a specific brand, make, manufacturer or specific name.

C. Adjust layout, system connections and coordinate with other trades as required to properly install equivalent products.

D. Where equivalent products are submitted, include all associated costs related to substitution in bid.

E. Furnish materials bearing the manufacturer's name and trade name. Provide UL label where a UL standard has been established for the particular material.

F. Furnish standard products of manufacturers regularly engaged in production of equipment types required for the work. Use the manufacturer's latest approved design.

G. Use the same manufacturer for equipment and materials of the same general type throughout the work to obtain uniform appearance, operation and maintenance.

H. Protect equipment and materials from dirt, water, chemical or mechanical injury and theft at all times during construction. Provide covers or shelter as required.

I. If materials or equipment are damaged at any time prior to final acceptance of the work, repair such damage at no additional cost. If materials or equipment are damaged by water, provide replacement no additional cost.

J. Follow manufacturer's directions completely in the delivery, storage, protection and installation of all equipment and materials. Notify the Architect/Engineer in writing of any conflicts between any requirements of the contract documents and manufacturer's directions. Obtain written instructions before proceeding with the work. The Contractor is responsible for correction of any work that does not comply with the manufacturer's directions or written instructions from the Architect/Engineer at no additional cost.

K. Repair any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. Repaint entire damaged panel or section per the field painting specifications in Division 09 at no additional cost.

1.06 OPERATION AND MAINTENANCE MANUALS

A. Refer to individual plumbing sections and Division 01.

1.07 PAINTING

A. Refer to Division 09.

B. Protect fixtures, valves, trim, etc. from field painting operations. Do not install escutcheons and trim until painting is complete.

1.08 LOCATIONS AND MEASUREMENTS

A. Location of plumbing work is shown on the drawings as accurately as possible. Field-verify all measurements to insure that the work suits the surrounding trim, finishes and/or construction. Provide adjustment as necessary.

B. Make minor relocations of work prior to installation as required or as directed by the Architect/Engineer at no additional cost.

1.09 SUPERVISION

A. Contractor to provide an authorized and competent representative to constantly supervise the work from the beginning to completion and final acceptance. Insofar as possible, keep the same foreman and workmen throughout the project duration.

B. Representatives of Architect/Engineer, Owner, and local inspection authorities will make inspections during the progress of the work. Contractor to accommodate such inspections and correct deficiencies noted.

1.10 QUALITY AND WORKMANSHIP

A. Contractor to employ skilled tradesmen, laborers and supervisors. Final product to be a neat, well finished, and professional installation.

B. Remove and replace any work considered substandard quality in the judgment of the Architect/Engineer.

1.11 EXCAVATION, TRENCHING AND BACKFILLING

A. Provide all excavation, trenching and backfilling as required to complete the work under this Division.

B. Contractor is responsible for investigating conditions prior to excavating and to exercise care during the excavation to avoid any utilities or other objects which may or may not be shown on the drawings.

C. Excavate so as not to endanger or damage existing utilities and structures. If damage occurs, repair damage to the satisfaction of the Architect/Engineer at no additional cost.

D. Lay out location of all ditching at grade and obtain approval from the Architect/Engineer prior excavating.

E. Remove and dispose of all surplus earth from the site.

F. Provide suitable backfill materials as required.

G. Perform excavation, trenching and shoring in accordance with rules and regulations set forth in Article XXI, Bulletin 1 “Trenching” as published in a separate bulletin by the North Carolina Department of Labor, Division of Standards and Inspection Construction Bureau.

H. Bid excavation work as unclassified with no extra payment for removal of rock, unsuitable soils, etc.

1.12 CLOSING IN WORK

A. Do not cover up or enclose work until it has been inspected, tested and approved by authorities having jurisdiction over the work. Uncover any such work for inspection and/or test at no additional cost. Restore the work to its original condition after inspection and/or test at no additional cost.

1.13 CUTTING AND PATCHING

A. Perform all cutting and patching necessary to install work under this Division.

B. Perform cutting and patching in professional, workmanlike manner.

C. Arrange work to minimize cutting and patching.

D. Do not cut joists, beams, girders, columns or any other structural members without written permission from the Architect/Engineer.

E. Cut opening only large enough to allow easy installation of piping, wiring or ductwork.

F. Patching material to match material removed.

G. Restore patched surface to its original appearance at completion of patching.

H. Where waterproofed surfaces are patched, maintain integrity of waterproofing.

I. Remove rubble and excess patching materials from the premises.

1.14 INTERPRETATION OF DRAWINGS

A. Drawings and specifications under this Division are complementary each to the other. Provide any work specified herein and/or indicated on the drawings.

B. Drawings are diagrammatic and indicate generally the location of fixtures, piping, devices, equipment, etc. Follow drawings as closely as possible, but arrange work to suit the finished surroundings and/or trim.

C. The words “furnish”, “provide”, and/or “install” as used in these drawings and specifications are interpreted to include all material and labor necessary to complete the particular item, system, equipment, etc.

D. Any omissions from either the drawings or specifications are unintentional. Contractor is responsible for notifying the Architect/Engineer of any pertinent omissions before submitting a bid. Complete and working systems are required, whether every small item of material is shown and specified or not.

1.15 ACCESSIBILITY

A. Locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment to include, but not be limited to, valves, traps, cleanouts, motors, controllers and drain points. If required for accessibility, furnish access doors for this purpose. Minor deviations from drawings may be made to allow for better accessibility.

B. Coordinate exact locations and size of access panels for each concealed device requiring service.

C. Access panels: Steel construction with 16 gauge frames and 18 gauge panels, factory primed with rust inhibiting paint, finish paint by Contractor. Provide suitable UL listed doors where installed in rated construction.

D. Coordinate access panel locations with architectural construction.

E. Access panels are not required for access to work located above a lift-out “T” bar type ceiling.

1.16 ELECTRICAL WORK IN CONNECTION WITH PLUMBING WORK

A. Comply with Division 26.

1.17 PLUMBING WORK IN CONNECTION WITH OTHER CONTRACTS

A. Provide plumbing services as required for items furnished by other contractors or vendors as shown on the plumbing drawings. Include rough-ins and final connections to equipment. Locations of connections shown on the drawings are approximate and some adjustment of actual connection locations should be anticipated. Coordinate exact connection requirements. Make final connections only after approval of the other contractor or vendor, in the contractor's or vendor's presence.

1. Natural Gas System- Provide complete gas piping supply from natural gas meter. Coordinate equipment gas requirements with supplier. Contractor is responsible for contacting natural gas supplier and complying with supplier connection and service piping requirements. Provide all required valves, regulators, accessories as shown on drawings.
2. Site Utilities- In general, work under this Division covers work to five feet outside buildings. Extend and connect work under this Division to site utilities as required.
3. Owner Furnished Equipment- Obtain exact plumbing requirements and rough-in locations for Owner furnished equipment. Provide complete plumbing installation for proper operation of equipment.
4. Kitchen Equipment- Obtaining exact plumbing requirements and rough-in locations for kitchen equipment. Provide complete plumbing installation for proper operation of equipment.

1.18 ALTERNATE BIDS

A. Alternate Bids are described in relevant sections of the General and Supplemental General Conditions and Division 1 Specification Sections.

1.19 PROJECT RECORD DRAWINGS

A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 01 Specification Sections.

B. As the work progresses, legibly record all field changes on a set of project contract drawings, herein after called the “record drawings.”

C. Accurately show the installed condition of plumbing work on record drawings.

1.20 PHASING OF THE WORK

A. Schedule work in accordance with the relevant sections of the General and Supplemental General Conditions and Division 01 Specifications Sections.

1.21 PROJECT CLOSEOUT

A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 01 Specifications Sections.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION

SECTION 220010
EXISTING PLUMBING CONDITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for plumbing work in existing building.

1.02 PROJECT CONDITIONS

A. Conform to the requirements of Division 01 for cutting and patching. Conform to the requirements of Division 2 and Section 220020 for demolition.

B. Conduct work to minimize interference with adjacent and occupied building areas.

C. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

PART 2 GENERAL

2.01 PATCHING MATERIALS

A. As specified in individual Sections.

PART 3 GENERAL

3.01 PREPARATION

A. Coordinate plumbing service interruptions with the Owner.

B. Provide temporary and/or permanent plumbing as shown and/or as required by conditions to maintain existing systems in service during construction. Use hot-tapping valves if required.

C. Existing Plumbing Systems: Maintain existing plumbing systems in service. Disable systems outside construction area only to make tie-ins or switchovers. Obtain permission from the Owner at least 24 hours before partially or completely disabling plumbing. Minimize duration. Make temporary connections as required to maintain service in areas adjacent to work area.

D. Drawings are based on casual field observation and existing record documents. Survey the affected areas before submitting bid proposal. Report discrepancies to the Architect/Engineer before disturbing the existing installation.

E. Field-verify existing conditions as related to interconnection of New Work. Determine exact methods of interface to obtain proper operation.

F. Coordinate existing and New Work interface prior to beginning any work. Adjust work to suit existing conditions. Some deviations in plan layout vs. actual conditions should be expected.

G. Provide, erect, and maintain temporary dust screens, safeguards, barricades, signage and similar measures, for protection of the public, Owner, Contractor=s employees, and existing construction to remain. Provide protective barriers indicated in the contract drawings.

3.02 EXISTING CONDITIONS

A. Verify existing conditions in field and determine which affect plumbing work. Secure utilities as required to prevent spills, leakage, etc.

B. Protect existing work to remain. Do not cut or remove any structural members.

C. Rework existing services to remain which interfere with new work.

END OF SECTION

SECTION 220020
PLUMBING DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective plumbing demolition.

B. Conform to the requirements of Division 01 for cutting and patching.

C. Conform to the requirements of Division 02 for selective demolition

1.02 PROJECT CONDITIONS

A. Conduct demolition to minimize interference with adjacent and occupied building areas.

B. Cease operations immediately if structure appears to be in danger and notify Architect/Engineer. Do not resume operations until directed.

1.03 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.

PART 2 GENERAL

2.01 PATCHING MATERIALS

A. As specified in individual Sections.

PART 3 GENERAL

3.01 PREPARATION

A. Demolition Drawings are based on casual field observation. No record documents are available. Survey the affected areas before submitting bid proposal. Report discrepancies to the Architect/Engineer before disturbing the existing installation.

B. Provide, erect, and maintain temporary dust screens, safeguards, barricades, signage and similar measures, for protection of the public, Owner, Contractor's employees, and existing construction to remain. Provide protective barriers indicated in the contract drawings.

C. Protect existing materials and existing improvements which are not to be demolished.

D. Prevent movement of structure; provide temporary bracing and shoring required to ensure safety of existing structure.

3.02 DEMOLITION

A. Disconnect, remove, cap, and identify plumbing work as indicated. Secure utilities as required to prevent spills, leakage, etc.

B. Demolish in an orderly and careful manner. Protect existing work to remain. Do not cut or remove any structural members.

C. Terminate all demolition work in a neat finished manner.

D. Conceal or enclose abandoned work within building construction except as specifically noted.

E. Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

F. Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

G. Coordinate cutting and patching requirements.

END OF SECTION

SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.
4. Silicone sealants.

B. Related Requirements:

1. Section 078413 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 PRODUCTS

2.01 SLEEVES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anti-corrosion coated, with plain ends and integral welded waterstop collar.

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

2.02 SLEEVE-SEAL SYSTEMS

A. Description:

1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
2. Designed to form a hydrostatic seal of 20-psig.

3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
4. Pressure Plates: Stainless steel.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.03 GROUT

A. Description: Non-shrink, recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.04 SILICONE SEALANTS

A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant, ASTM C 920, Type S, Grade NS, Class 25, use NT.

B. Silicone, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT. Grade P Pourable (self-leveling) formulation is for opening in floors and other horizontal surfaces that are not fire rated.

C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 EXECUTION

3.01 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use sealants appropriate for size, depth, and location of joint.

E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke-Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."

3.02 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal-system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.

B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

3.04 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls Above Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Steel pipe sleeves.

2. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs Above Grade:

   a. Piping Smaller Than NPS 6: Steel pipe sleeves.
   b. Piping NPS 6 and Larger: Steel pipe sleeves.

4. Interior Partitions:

   a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
   b. Piping NPS 6 and Larger: PVC-pipe sleeves.

END OF SECTION

SECTION 220518
ESCUTCHEONS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated or polished brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished, chrome-plated finish and spring-clip fasteners.

2.02 FLOOR PLATES

A. Split Floor Plates: Steel with concealed hinge.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
b. Insulated Piping: One-piece cast brass with polished, chrome-plated finish.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece cast brass with polished, chrome-plated finish.

e. Bare Piping in Unfinished Service Spaces: One-piece cast brass with rough-brass finish.
f. Bare Piping in Equipment Rooms: One-piece cast brass with rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: Split floor plate.

3.02 FIELD QUALITY CONTROL

A. Using new materials, replace broken and damaged escutcheons and floor plates.

END OF SECTION

SECTION 220519
METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Thermometers.
2. Gages.
3. Test plugs.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Wiring Diagrams: For power, signal, and control wiring.

1.03 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage, from manufacturer.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

1.05 SPARE PARTS

A. Provide one spare certified calibrated gauge of each type to be utilized for testing/comparison purposes.

PART 2 PRODUCTS

2.01 LIGHT-ACTIVATED THERMOMETERS

A. Direct-Mounted, Light-Activated Thermometers:

1. Case: Metal; 7-inch nominal size unless otherwise indicated.
2. Scale(s): Deg F and deg C.
3. Case Form: Adjustable angle.
4. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
5. Stem: Aluminum and of length to suit installation.

    a. Design for Thermowell Installation: Bare stem.

6. Display: Digital.
7. Accuracy: Plus or minus 2 deg F.

2.02 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.03 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Standard: ASME B40.100.
2. Case: Sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass.
9. Ring: Brass.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.04 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass pipe with NPS 1/4 or NPS 1/2 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.05 TEST PLUGS

A. Description: Test-station fitting made for insertion into piping tee fitting.

B. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

C. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.

D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

E. Core Inserts: EPDM self-sealing rubber.

2.06 TEST-PLUG KITS

A. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

B. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

C. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

D. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids (except steam).

H. Install valve and syphon fitting in piping for each pressure gage for steam.

I. Install test plugs in piping tees.

J. Install flow indicators in piping systems in accessible positions for easy viewing.

K. Install connection fittings in accessible locations for attachment to portable indicators.

L. Install thermometers in the following locations:

1. Domestic Hot Water Storage Tank.
2. Inlet and outlet of each domestic water heater.
3. Domestic hot water return piping in mechanical room.

M. Install pressure gages in the following locations:

1. Domestic Water Service Entrance.
2. Inlet and outlet of each domestic water pump.
3. Backflow preventer inlet and outlet.
4. LP gas regulator inlet.
5. LP gas regulator outlet.

3.02 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.03 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

C. Thermometer stems shall be of length to match thermowell insertion length.

3.04 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Water Piping: 0 to 250 deg F.

3.05 PRESSURE-GAGE SCHEDULE

A. Pressure gages shall be the following:

1. Sealed, direct-mounted, metal case.

3.06 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range Water Piping: 0 to 100 psi.

END OF SECTION

SECTION 220523.12
BALL VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bronze ball valves.
2. Steel ball valves

1.03 DEFINITIONS

A. CWP: Cold working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads.
3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Refer to Plumbing Valve Schedule articles for applications of valves.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Handlever.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

I. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:

1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 400 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.03 STEEL BALL VALVES

A. Steel Ball Valves with Full Port, Class 150:

1. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 285 psig.
c. Body Design: Split body.
d. Body Material: Carbon steel, ASTM A 216, Type WCB.
e. Ends: Flanged or threaded.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.03 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below:

3.04 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze ball valves, two-piece with full port and stainless-steel trim.

B. Pipe NPS 2-1/2 and Larger:

1. Steel and Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Steel ball valves, Class 150 with full port.

END OF SECTION

SECTION 220523.14

CHECK VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Bronze swing check valves.
2. Iron swing check valves with closure control.

1.03 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. SWP: Steam working pressure.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Block check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
4. ASME B16.18 for solder joint.
5. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.02 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:

1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

2.03 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Iron Swing Check Valves with Lever- and Spring-Closure Control, Class 125:

1. Description:

a. Standard: MSS SP-71, Type I.
b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
c. Body Design: Clear or full waterway.
d. Body Material: ASTM A 126, gray iron with bolted bonnet.
e. Ends: Flanged.
f. Trim: Bronze.
g. Gasket: Asbestos free.
h. Closure Control: Factory-installed, exterior lever and spring.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.02 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.

F. Install valve tags. Comply with requirements for valve tags and schedules in Section 220553 "Identification for Plumbing Piping and Equipment."

3.03 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.04 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules.
2. For Steel Piping, NPS 2-1/2 to NPS 6: Flanged ends.

3.05 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Swing Check Valves with Nonmetallic Disc, Class 125.

B. Pipe NPS 2-1/2 and Larger:

1. NPS 2-1/2 to NPS 12: Iron swing check valves with lever and spring-closure control, Class 125.

END OF SECTION

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Thermal-hanger shield inserts.
   4. Equipment supports.

B. Related Sections:
   1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
   2. Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.04 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
   1. Trapeze pipe hangers.
   2. Pipe stands.
   3. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers 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 trapeze hangers.
   2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.06 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.07 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 PRODUCTS

2.01 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.02 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.03 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

B. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.04 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.05 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 EXECUTION

3.01 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
5. Thermal-Hanger Shields: Install with insulation same thickness as piping ins.

3.02 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.03 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.04 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.05 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
    1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.06 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use padded hangers for piping that is subject to scratching.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
   6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
   7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
   10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
   11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
   12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
   14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
   16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
   3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
   4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
   5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   6. C-Clamps (MSS Type 23): For structural shapes.
   7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
   8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
   9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
   10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
   11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
   12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
      a. Light (MSS Type 31): 750 lb.
      b. Medium (MSS Type 32): 1500 lb.
      c. Heavy (MSS Type 33): 3000 lb.
   13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
   15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 220548.13

VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Elastomeric hangers.

B. Related Requirements:
   1. Section 230548.13 "Vibration Controls for HVAC" for devices for HVAC equipment and systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
   2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.

PART 2 PRODUCTS

2.01 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:.
   1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
   2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices 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.

3.02 VIBRATION CONTROL DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Valve tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve numbering scheme.

D. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Comply with ASME A13.1.
3. Background Color: Comply with ASME A13.1.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Labels shall include equipment number, area(s) served (use actual room numbers used at the facility-not architectural room numbers), substantial completion date (S.C.), extended warranty period, temperature setting, and capacity. The following are examples of labelling to be used:

Water Heaters:	GWH01 (Mechanical Room) S.C.: 11/16/2005 Capacity: 500 gallon Temperature Setting: 140 deg. F
Pumps:	HWRP01 (HW Rec. Pump - Buildings 100 & 200) S.C.: 11/16/2005 Capacity: 20 gpm @ 15 ft head.
Access Doors:	Domestic Water Isolation Valves Restroom 102

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: Size letters according to ASME A13.1 for piping.
3. Colors: Comply with ASME A13.1, unless otherwise indicated.

2.03 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain, beaded chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.03 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Piping Color Coding: Paint and color-code all exposed piping located in equipment rooms. Piping shall be color coded as follows with flow arrows and labels located at 10 foot intervals, at all turns and at each floor or wall partition:

Domestic Cold Piping: Dark Blue
Domestic Hot Piping: Dark Red
Natural Gas Piping: Yellow

B. Provide ceiling valve marker for valves located above lay-in ceilings. Above ceiling valve markers shall be 1/2 inch diameter self-adhesive color-coded circle. Color code as noted above. Attach valve marker to adjacent ceiling grid.

C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe Label Color Schedule:

1. Domestic Water Piping

   a. Background: Comply with ASME A13.1.
   b. Letter Colors: Comply with ASME A13.1.

2. Sanitary Waste and Storm Drainage Piping:

   a. Background Color: Comply with ASME A13.1.
   b. Letter Color: Comply with ASME A13.1.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Contractor to furnish valve schedule mounted behind glass in a frame located in main mechanical room.

C. Contractor to furnish valve schedule in O&M manuals. Indicated valve tag number, location and service.

D. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

   a. Cold Water: 1-1/2 inches, round.
   b. Hot Water: 1-1/2 inches, round.

2. Valve-Tag Colors:

   a. Cold Water: Comply with ASME A13.1.
   b. Hot Water: Comply with ASME A13.1.

3. Letter Colors:

   a. Cold Water: Comply with ASME A13.1.
   b. Hot Water: Comply with ASME A13.1.

END OF SECTION

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Roof drains and rainwater leaders.
5. Supplies and drains for handicap-accessible lavatories and sinks.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.07 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.08 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Mineral-Fiber, Preformed Pipe Insulation:

1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.05 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.06 SEALANTS

A. ASJ Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.07 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

2.08 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

2.09 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14. Prime metal jacket with paint grip finish.

   a. Sheet and roll stock ready for shop or field sizing.
   b. Finish and thickness are indicated in field-applied jacket schedules.
   c. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper.
   d. Factory-Fabricated Fitting Covers:

      1) Same material, finish, and thickness as jacket.
      2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      3) Tee covers.
      4) Flange and union covers.
      5) End caps.
      6) Beveled collars.
      7) Valve covers.
      8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

2.11 SECUREMENTS

A. Bands:

1. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

2.12 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.03 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.04 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.05 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Finish exposed surfaces with a metal jacket.

3.06 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.07 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.08 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified in Section 220553 “Identification for Plumbing Piping and Equipment.”

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold and Hot Water:

1. Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Recirculated Hot Water:

1. Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inches thick.

C. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. Insulation of roof drain pan shall also be required.

D. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Piping, exposed insulated lines within 8 ft. above floor in occupied spaces:

1. Painted Aluminum, Smooth: 0.024 inch thick, Color-Coded by System.

C. Piping, exposed in equipment rooms:

1. Painted field applied cloth woven glass fiber fabric, Color-Coded by System.

END OF SECTION

SECTION 221116
DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Piping joining materials.
3. Transition fittings.

B. This Division is applicable to domestic cold and hot water piping within building to a point 5 feet outside the building.

1.03 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.04 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G.

C. Comply with NSF Standard 372 for low lead.

2.02 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

D. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.

3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

E. Pressure-Seal-Joint Fittings, Copper or Bronze - Domestic Water:

1. Housing: Copper.
2. O-Rings and Pipe Stops: EPDM.
3. Tools: Manufacturer's special tools.
4. Minimum 200 psig working-pressure rating at 250 deg F.

2.03 PIPING JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys.

B. Flux: ASTM B 813, water flushable.

2.04 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Plastic-to-Metal Transition Fittings:

1. Description:

a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket end.

D. Plastic-to-Metal Transition Unions:

1. Description:

a. CPVC or PVC four-part union.
b. Solvent-cement-joint plastic end.
c. Rubber O-ring.
d. Union nut.

PART 3 EXECUTION

3.01 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5. Do not locate joints below slab of building.

D. Install shutoff valve, hose-end drain valve, pressure gage, and test tee with valve inside the building at domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install domestic water piping level without pitch and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

I. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

K. Install piping to permit valve servicing.

L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

M. Install piping free of sags and bends.

N. Install fittings for changes in direction and branch connections.

O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

P. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

Q. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

R. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.03 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

D. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.04 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

B. Support vertical piping and tubing at base and at each floor.

C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

E. Install supports for vertical copper tubing every 10 feet.

F. Support piping and tubing not listed in this article according to MSS SP-58 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.07 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.08 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and

allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.09 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

   b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.

   b. Fill and isolate system according to either of the following:

      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

      2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

   c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

   d. Repeat procedures if biological examination shows contamination.

   e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Under-building-slab, domestic water, building-service piping shall be the following:

1. Soft copper tube, ASTM B 88, Type K; no joints.

C. Aboveground domestic water piping shall be any of the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Temperature-actuated, water mixing valves.
5. Strainers.
6. Drain valves.
7. Water-hammer arresters.

B. Related Requirements:

1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Section 221116 "Domestic Water Piping" for water meters.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 Annex G.

2.02 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.03 VACUUM BREAKERS

A. Hose-Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated.

2.04 BACKFLOW PREVENTERS

A. Double-Check, Backflow-Prevention Assemblies:

1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Refer to Plumbing Fixture Schedule for further information.
5. Accessories:

   a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.

B. Beverage-Dispensing-Equipment Backflow Preventers:

1. Standard: ASSE 1022.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/4 or NPS 3/8.
4. Body: Stainless steel.
5. End Connections: Threaded.
6. Refer to Plumbing Fixture Schedule for further information.

C. Hose-Connection Backflow Preventers:

1. Standard: ASSE 1052.
2. Operation: Up to 10-foot head of water back pressure.
3. Inlet Size: NPS 1/2 or NPS 3/4.
4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
5. Capacity: At least 3-gpm flow.

2.05 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Type: Ball valve with two readout ports and memory-setting indicator.
2. Body: bronze.
3. Size: Same as connected piping, but not larger than NPS 2.
4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.06 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Individual-Fixture, Water Tempering Valves, MX1:

1. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze body with corrosion-resistant interior components.
4. Temperature Control: Adjustable.
5. Inlets and Outlet: Threaded.
6. Finish: Rough or chrome-plated bronze.

7. Tempered-Water Setting: 110 deg F.
8. Tempered-Water Design Flow Rate: 1.5 gpm.

2.07 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.033 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.08 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.09 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install balancing valves in locations where they can easily be adjusted.

C. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

D. Install Y-pattern strainers where indicated on plans and risers.

E. Install water-hammer arresters in water piping according to PDI-WH 201.

3.02 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.03 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Double-check, backflow-prevention assemblies.
2. Calibrated balancing valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each double-check, backflow-prevention assembly according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.05 ADJUSTING

A. Set field-adjustable flow set points of balancing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 221123
DOMESTIC WATER PUMPS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.

1.03 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.06 QUALITY ASSURANCE

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. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

PART 2 PRODUCTS

2.01 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

B. Refer to Plumbing Fixture Schedule on design drawings for additional information.

2.02 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.03 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 50 to 125 deg F.
3. Operation of Pump: On or off.
4. Transformer: Provide if required.
5. Power Requirement: 120 V ac.
6. Settings: Start pump at 105 deg F and stop pump at 120 deg F.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.02 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install thermostats in hot-water return piping.

3.03 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

3.04 IDENTIFICATION

A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.05 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.
    d. Verify that pump is controlled by thermostat system.

5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.
8. Adjust timer settings.

3.06 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION

SECTION 221126

FACILITY LIQUEFIED-PETROLEUM GAS PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping and tubing joining materials.
3. Valves.
4. Pressure regulators.

1.03 DEFINITIONS

A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

D. LPG: Liquefied-petroleum gas.

1.04 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. For Piping Containing Only Vapor:

a. Piping and Valves: 125 psig unless otherwise indicated.

B. LPG System Pressure within Buildings: Refer to drawings.

C. Delegated Design: Design restraints and anchors for LPG piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
2. Pressure regulators. Indicate pressure ratings and capacities.
3. Dielectric fittings.

B. Delegated-Design Submittal: For LPG piping and equipment 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 seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.06 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Submit certification that piping will withstand seismic forces defined on structural drawings." Include the following:

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.

B. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For LPG equipment and accessories to include in emergency, operation, and maintenance manuals.

1.08 QUALITY ASSURANCE

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.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 083113 "Access Doors and Frames."

PART 2 PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A53/A53M, black steel, Schedules 40 and 80, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

B. Annealed-Temper Copper Tube: Comply with ASTM B88, Type L.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.

2.02 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for LPG.

2.03 MANUAL GAS SHUTOFF VALVES

A. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Body: Bronze, complying with ASTM B584.
2. Ball: Chrome-plated bronze
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig.
8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for LPG service with "WOG" indicated on valve body.

2.04 MOTORIZED GAS VALVES

A. Electrically Operated Valves: Comply with UL 429.

1. Pilot operated.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, replaceable.
6. NEMA ICS 6, Type 4, coil enclosure.
7. Normally closed.
8. Visual position indicator.

2.05 EARTHQUAKE VALVES

A. Earthquake Valves, Maximum Operating Pressure of 5 psig: Comply with ASCE 25.

1. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
2. Maximum Operating Pressure: 5 psig.
3. Cast-aluminum body with nickel-plated chrome steel internal parts.
4. Nitrile-rubber valve washer.
5. Sight windows for visual indication of valve position.
6. Threaded-end connections complying with ASME B1.20.1.

2.06 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for LPG.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream and not exceed 150 percent of design discharge pressure at shutoff.
9. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
10. Maximum Inlet Pressure: 2 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 1 psig.

2.07 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.08 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for LPG piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.03 PREPARATION

A. Inspect LPG piping according to NFPA 58 and North Carolina Fuel Gas Code to determine that LPG utilization devices are turned off in piping section affected.

B. Comply with NFPA 58 and and North Carolina Fuel Gas Code requirements for prevention of accidental ignition.

3.04 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 58 and and North Carolina Fuel Gas Code requirements for installation and purging of LPG piping.

B. Install underground, LPG piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

   1. If LPG piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, LPG piping according to ASTM D2774.

D. Copper Tubing with Protective Coating:

   1. Apply joint cover kits over tubing to cover, seal, and protect joints.
   2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

E. Install fittings for changes in direction and branch connections.

F. Joints for connection to inlets and outlets on vaporizers, air mixers, regulators, and valves may be flanged or threaded to match the equipment.

3.05 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and North Carolina Fuel Gas Code for installation and purging of LPG piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install LPG piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where readily accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed LPG piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: LPG piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

   a. Exception: Tubing passing through partitions or walls does not require striker barriers.

3. Prohibited Locations:

   a. Do not install LPG piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
   b. Do not install LPG piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

T. Do not use LPG piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage downstream from each line regulator. Pressure gages are specified in Section 220519 "Meters and Gages for Plumbing Piping."

W. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.06 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

3.07 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full ID of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Ch. 22, "Pipe and Tube."

3.08 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220000 "General Plumbing."

B. Comply with requirements for pipe hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

C. Install hangers for steel piping with maximum spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping within 12 inches of each fitting.

E. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.09 CONNECTIONS

A. Install LPG piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

B. Install piping adjacent to appliances to allow service and maintenance of appliances.

C. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliances and equipment. Install union between valve and appliances or equipment.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.10 LABELING AND IDENTIFYING

A. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.11 PAINTING

A. Paint exposed, exterior metal piping, valves, regulators, service meters and earthquake valves, and piping specialties, except components with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (semigloss).
d. Color: Gray.

B. Paint exposed, interior metal piping, valves, and regulators except components with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (semigloss).
d. Color: Yellow.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.12 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.

2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Use 3000-psig, 28-day, compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.13 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge LPG according to NFPA 58 and North Carolina Fuel Gas Code] and requirements of authorities having jurisdiction.

C. LPG piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.14 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain LPG equipment.

3.15 OUTDOOR PIPING SCHEDULE

A. Underground LPG vapor piping shall be the following:

1. Annealed -temper copper tube, Type L with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

B. Aboveground LPG vapor piping shall be the following:

1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES UP TO 2 PSIG

A. Aboveground, piping shall be the following:

1. Schedule 40, steel pipe with malleable-iron fittings and threaded joints.

3.17 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Waste, Force-Main Piping: 100 psig.

2.02 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.03 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, Service class.

B. Gaskets: ASTM C 564, rubber.

2.04 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Heavy-Duty, Hubless-Piping Couplings:

1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.05 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.

C. Copper Pressure Fittings:

1. Copper Fittings: ASME B16.18, wrought-copper, solder-joint fittings.
2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

2.06 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:

   a. Standard: ASTM C 1173.
   b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   c. End Connections: Same size as and compatible with pipes to be joined.
   d. Sleeve Materials:

      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

3. Shielded, Nonpressure Transition Couplings:

   a. Standard: ASTM C 1460.
   b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
   c. End Connections: Same size as and compatible with pipes to be joined.

4. Pressure Transition Couplings:

   a. Standard: AWWA C219.
   b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
   c. Center-Sleeve Material: [Manufacturer's standard] [Carbon steel] [Stainless steel] [Ductile iron] [Malleable iron].
   d. Gasket Material: Natural or synthetic rubber.
   e. Metal Component Finish: Corrosion-resistant coating or material.

PART 3 EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Plumbing Specialties:

1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

   a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
   b. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install drains in sanitary waste gravity-flow piping.

   a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls.

1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

S. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

T. Install force mains at elevations indicated.

U. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

V. Install underground, copper, force-main tubing according to CDA's "Copper Tube Handbook."

3.03 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

3.04 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
3. In Underground Force Main Piping:

   a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
   b. NPS 2 and Larger: Pressure transition couplings.

3.05 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

5. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
2. NPS 3: 60 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

F. Install supports for vertical cast-iron soil piping every 15 feet.

G. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.06 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

F. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

G. Install supports for vertical copper tubing every 10 feet.

3.07 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.08 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in piping.

a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

   a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

   a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
   b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
   c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

   a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
   b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
   c. Air pressure must remain constant without introducing additional air throughout period of inspection.
   d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved.

   a. Expose work that was covered or concealed before it was tested.

2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials.

   a. Isolate test source and allow to stand for four hours.
   b. Leaks and loss in test pressure constitute defects that must be repaired.

3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.09 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

C. Aboveground, vent piping shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.

E. Aboveground sanitary-sewage force mains shall be the following:

1. Hard copper tube, Type L; copper pressure fittings; and soldered joints.

F. Underground sanitary-sewage force mains shall be the following:

1. Soft copper tube, Type L; wrought-copper pressure fittings; and soldered joints.

END OF SECTION

SECTION 221319

SANITARY WASTE PIPING SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Air-admittance valves.
3. Roof flashing assemblies.
4. Through-penetration firestop assemblies.
5. Miscellaneous sanitary drainage piping specialties.

B. Related Requirements:

1. Section 221423 "Storm Drainage Piping Specialties" for roof drains.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 PRODUCTS

2.01 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.02 CLEANOUTS

A. Cast-Iron Exposed Cleanouts:

1. Standard: ASME A112.36.2M.
2. Size: Same as connected drainage piping
3. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, brass plug.

5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Threaded, adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Not required.
6. Outlet Connection: Threaded.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron with threads.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Square.
11. Top Loading Classification: Medium Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.
3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
4. Closure Plug:

   a. Brass.
   b. Countersunk or raised head.
   c. Drilled and threaded for cover attachment screw.
   d. Size: Same as or not more than one size smaller than cleanout size.

5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.03 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly approved by roof manufacturer.

2.04 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. Standard: UL 1479 assembly of sleeve-and-stack fitting with firestopping plug.
2. Size: Same as connected soil, waste, or vent stack.
3. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.

2.05 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
2. Size: Same as connected waste piping.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

    a. NPS 2: 4-inch-minimum water seal.
    b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

D. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

E. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 2 inches above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

F. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

G. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

E. Assemble open drain fittings and install with top of hub 2 inches above floor.

F. Install deep-seal traps on floor drains and other waste outlets, if indicated.

G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

I. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

J. Install wood-blocking reinforcement for wall-mounting-type specialties.

K. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.02 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.03 FLASHING INSTALLATION

A. Comply with roof manufacturer’s requirements.

3.04 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 223300

ELECTRIC, DOMESTIC-WATER HEATERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Commercial, light-duty, storage, electric, domestic-water heaters.
2. Domestic-water heater accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

1.04 INFORMATIONAL SUBMITTALS

A. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

B. Source quality-control reports.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For electric, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

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. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

   a. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

      1) Storage Tank: Five years.
      2) Controls and Other Components: Two years.

   b. Compression Tanks: Five years.

PART 2 PRODUCTS

2.01 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1. Standard: UL 174.
2. Storage-Tank Construction: Steel, vertical arrangement.

   a. Tappings: ASME B1.20.1 pipe thread.
   b. Pressure Rating: 150 psig.
   c. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining material into tappings.

3. Factory-Installed Storage-Tank Appurtenances:

   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: ASSE 1005.
   d. Insulation: Comply with ASHRAE/IESNA 90.1.
   e. Jacket: Steel with enameled finish.
   f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
   g. Heating Elements: Two; electric, screw-in immersion type; wired for non-simultaneous operation.
   h. Temperature Control: Adjustable thermostat.
   i. Safety Control: High-temperature-limit cutoff device or system.
   j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction with legs for off-floor installation.

B. Capacity and Characteristics:

1. Refer to Plumbing Fixture Schedule for additional information.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:

   a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
   b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

   a. Refer to Plumbing Fixture Schedule for additional information.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

E. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.

2.03 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on floor or on domestic-water heater mounting bracket as indicated on plans.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

C. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

D. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

E. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

F. Fill electric, domestic-water heaters with water.

G. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 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 assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain commercial, electric, domestic-water heaters.

END OF SECTION

SECTION 223400

FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Commercial, power-vent, gas-fired, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.03 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

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. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.07 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Structural failures including storage tank and supports.
   b. Faulty operation of controls.
   c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

   a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

      1) Storage Tank: Five years.
      2) Controls and Other Components: Two year(s).

   b. Compression Tanks: Five years.

PART 2 PRODUCTS

2.01 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Power-Vent, Gas-Fired, Storage, Domestic-Water Heaters:

1. Standard: ANSI Z21.10.3/CSA 4.3.
2. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

   a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

      1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
      2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

   b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
   c. Lining: Glass complying with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

3. Factory-Installed Storage-Tank Appurtenances:

   a. Anode Rod: Replaceable magnesium.
   b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
   c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.

d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner: For use with power-vent, gas-fired, domestic-water heaters and natural-gas fuel.
g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
h. Temperature Control: Adjustable thermostat.
i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.
5. Power-Vent System: Exhaust fan, interlocked with burner.

2.02 DOMESTIC-WATER HEATER ACCESSORIES

A. Vent Piping:

1. Description: PVC, as recommended by water heater manufacturer.
2. Termination: Sidewall intake and exhaust. Concentric vents are acceptable.

B. Domestic-Water Compression Tanks:

1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

a. Working-Pressure Rating: 100 psig.
b. Capacity Acceptable: 4 gal. minimum.
c. Air Precharge Pressure: 12 psig.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

F. Comply with requirements for ball- or butterfly-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.13 "Butterfly Valves for Plumbing Piping."

1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

H. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 2-psig pressure rating as required to match gas supply.

I. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

J. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

2.03 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 EXECUTION

3.01 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.13 "Butterfly Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.13 "Butterfly Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill domestic-water heaters with water.

J. Charge domestic-water compression tanks with air.

3.02 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.03 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.04 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 assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION

SECTION 224213.13
COMMERCIAL WATER CLOSETS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.

1.03 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

1.04 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 water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

PART 2 PRODUCTS

2.01 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS, FLUSHOMETER VALVES AND TOILET SEATS

A. Refer to Plumbing Fixture Schedule on design drawings for further information.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.05 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224213.16

COMMERCIAL URINALS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.01 WALL-HUNG URINALS, FLUSHOMETER VALVES

A. Refer to Plumbing Fixture Schedule on design drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.

3.03 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.04 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls. Adjust water pressure at flushometer valves to produce proper flow.

3.05 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224216.13
COMMERCIAL LAVATORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.
3. Supply fittings.
4. Waste fittings.
5. Supports.

1.03 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 lavatories.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 PRODUCTS

2.01 LAVATORIES AND FAUCETS

A. Refer to Plumbing Fixture Schedule on design drawings for further information.

2.02 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.
2. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.03 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.04 SUPPORTS

A. Type II Lavatory Carrier:

1. Standard: ASME A112.6.1M.

B. Type III Lavatory Carrier:

1. Standard: ASME A112.6.1M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224216.16
COMMERCIAL SINKS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Service basins.
2. Service sinks.
3. Sink faucets.
4. Supports.
5. Supply fittings.
6. Waste fittings.

1.03 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 sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 PRODUCTS

2.01 SERVICE BASINS

A. Refer to Plumbing Fixture Schedule on design drawings for further information.

2.02 SERVICE SINKS

A. Refer to Plumbing Fixture Schedule on design drawings for further information.

2.03 SINK FAUCETS

A. Refer to Plumbing Fixture Schedule on design drawings for further information.

2.04 SUPPORTS

A. Type II Sink Carrier:

1. Standard: ASME A112.6.1M.

2.05 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

F. Risers:

1. NPS 1/2.
2. Chrome-plated, rigid-copper pipe.

2.06 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.07 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.03 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.05 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224716
PRESSURE WATER COOLERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes pressure water coolers and related components.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 PRODUCTS

2.01 PRESSURE WATER COOLERS

A. Refer to Plumbing Fixture Schedule on design drawings for further information.

2.02 SUPPORTS

A. Type I Water Cooler Carrier:

1. Standard: ASME A112.6.1M.

B. Type II Water Cooler Carrier:

1. Standard: ASME A112.6.1M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set freestanding pressure water coolers on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers to mounting frames.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.03 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.04 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.05 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 230548.13

VIBRATION CONTROLS FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Elastomeric isolation pads.
   2. Elastomeric hangers.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 PRODUCTS

2.01 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:
   1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
   2. Size: Factory or field cut to match requirements of supported equipment.
   3. Pad Material: Oil and water resistant with elastomeric properties.
   4. Surface Pattern: Ribbed pattern.
   5. Infused nonwoven cotton or synthetic fibers.
   6. Load-bearing metal plates adhered to pads.

2.02 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
   1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
   2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 VIBRATION CONTROL DEVICE INSTALLATION

A. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

B. Install Elastomeric Isolation Pads under each air handling unit base mounting rail at spacing recommended by pad manufacturer.

C. Install elastomeric hangers at suspended fan installations.

END OF SECTION

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.
   3. Duct labels.
   4. Stencils.
   5. Valve tags.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 PRODUCTS

2.01 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
   7. Fasteners: Stainless-steel rivets.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.02 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: Size letters according to ASME A13.1 for piping.

2.03 STENCILS

A. Stencils for Ducts:
   1. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances up to 15 feet and proportionately larger lettering for greater viewing distances.
   2. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.

B. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
   1. Lettering Size: Minimum letter height of 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.
   2. Stencil Paint: Exterior, gloss, acrylic enamel. Paint may be in pressurized spray-can form.

2.04 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire-link chain.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. For concealed valves, equipment, and devices needing service, provide identification markers visible from floor. Use color dot stickers placed on ceiling grid where valves, equipment, and devices needing service are installed above. Color scheme to be in accordance with Owner's color coding standard.

3.03 EQUIPMENT LABEL INSTALLATION

A. All major HVAC equipment, including air handlers, air terminal units, fans and pumps shall be properly identified with equipment tag stating equipment ID, ratings and date of installation.

B. Install or permanently fasten labels on each major item of mechanical equipment.

C. Locate equipment labels where accessible and visible.

3.04 PIPE LABEL INSTALLATION

A. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
   1. Identification Paint: Use for contrasting background.
   2. Stencil Paint: Use for pipe marking.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
   4. At access doors, manholes, and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
   7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

D. Pipe Label Color Schedule:
   1. Heating -Water Piping: White letters on a safety-green background.
   2. Refrigerant Piping: White letters on a safety-purple background.

3.05 DUCT LABEL INSTALLATION

A. Stenciled Duct Label: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.

B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.06 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
   1. Valve-Tag Size and Shape:
      a. Heating Hot Water: 2 inches, round.
   2. Valve-Tag Colors:
      a. Heating Hot Water: White letters on a safety-green background.

3.07 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Balancing Air Systems:
      a. Constant-volume air systems (including unit heaters, exhaust fans, package units and split systems).
      b. Variable-air-volume systems (package units).
   2. Testing, Adjusting, and Balancing Equipment:
      a. Motors.
      b. Condensing units.
      c. Heat-transfer coils.
   3. Domestic water recirculation.
   4. Domestic hot water system.
   5. Control system verification.

1.03 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.04 PREINSTALLATION MEETINGS

A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
   1. Minimum Agenda Items:
      a. The Contract Documents examination report.
      b. The TAB plan.
      c. Needs for coordination and cooperation of trades and subcontractors.
      d. Proposed procedures for documentation and communication flow.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Record log of duct leakage tests submitted to designer and/or commissioning agent upon completion.

I. Instrument calibration reports, to include the following:
   1. Instrument type and make.
   2. Serial number.
   3. Application.
   4. Dates of use.
   5. Dates of calibration.

1.06 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by NEBB or AABC.
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or AABC.
   2. TAB Technician: Employee of the TAB specialist and certified by NEBB or AABC as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

1.07 FIELD CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.02 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:
    a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    b. Duct systems are complete with terminals installed.
    c. Volume, smoke, and fire dampers are open and functional.
    d. Clean filters are installed.
    e. Fans are operating, free of vibration, and rotating in correct direction.
    f. Variable-frequency controllers' startup is complete and safeties are verified.
    g. Automatic temperature-control systems are operational.
    h. Ceilings are installed.
    i. Windows and doors are installed.
    j. Suitable access to balancing devices and equipment is provided.

3.03 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
    1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts. Mark exterior of repaired duct insulation with location of test holes for Commissioning purposes.
    2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.05 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
      c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
      d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
   2. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan inlet or through the flexible connection.
      c. Measure static pressure across each component that makes up the air-handling system.
      d. Report artificial loading of filters at the time static pressures are measured.
   3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
   4. Obtain approval from Construction Manager for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
   5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
   1. Measure airflow of submain and branch ducts.
   2. Adjust submain and branch duct volume dampers for specified airflow.
   3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
   1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
   2. Measure inlets and outlets airflow.
   3. Adjust each inlet and outlet for specified airflow.
   4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.
   1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
   2. Re-measure and confirm that total airflow is within design.
   3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
   4. Mark all final settings.
   5. Test system in economizer mode. Verify proper operation and adjust if necessary.
   6. Measure and record all operating data.
   7. Record final fan-performance data.

3.06 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:
   1.
   2. Verify that the system is under temperature and humidity control.
   3. For belt-driven exhaust fan, balance at or above 90% of the maximum speed utilizing pulley and/or sheave adjustment.
   4. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
      a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
      b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
      c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
      d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
   5. Measure fan static pressures as follows:
      a. Measure static pressure directly at the fan outlet or through the flexible connection.
      b. Measure static pressure directly at the fan inlet or through the flexible connection.
      c. Measure static pressure across each component that makes up the air-handling system.
      d. Report any artificial loading of filters at the time static pressures are measured.
   6. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
      a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
      b. Verify that terminal units are meeting design airflow under system maximum flow.
   7. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
   8. Verify final system conditions as follows:
      a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
      b. Re-measure and confirm that total airflow is within design.
      c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
      d. Mark final settings.
      e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
      f. Verify tracking between supply and return fans.

3.07 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
   1. Manufacturer's name, model number, and serial number.
   2. Motor horsepower rating.
   3. Motor rpm.
   4. Phase and hertz.
   5. Nameplate and measured voltage, each phase.
   6. Nameplate and measured amperage, each phase.
   7. Starter size and thermal-protection-element rating.
   8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

C. Record final motor speed or frequency at balanced conditions in addition to nameplate speed.

3.08 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record fan and motor operating data.

3.09 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:
   1. Entering- and leaving-water temperature.
   2. Water flow rate.
   3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
   4. Dry-bulb temperature of entering and leaving air.
   5. Wet-bulb temperature of entering and leaving air for cooling coils.
   6. Airflow.

B. Measure, adjust, and record the following data for each electric heating coil:
   1. Nameplate data.
   2. Airflow.
   3. Entering- and leaving-air temperature at full load.
   4. Voltage and amperage input of each phase at full load.
   5. Calculated kilowatt at full load.
   6. Fuse or circuit-breaker rating for overload protection.

C. Measure, adjust, and record the following data for each steam coil:
   1. Dry-bulb temperature of entering and leaving air.
   2. Airflow.
   3. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:
   1. Dry-bulb temperature of entering and leaving air.
   2. Wet-bulb temperature of entering and leaving air.
   3. Airflow.

3.10 PROCEDURES FOR DOMESTIC HOT WATER SYSTEM

A. Adjust pumps to deliver total design gpm.
   1. Measure total water flow.
      a. Position valves for full flow.
      b. Measure flow by main flow meter, if installed.
      c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
   2. Measure pump TDH as follows:
      a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
      b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
      c. Convert pressure to head and correct for differences in gage heights.
      d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.
      e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Verify final system conditions as follows:
1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

3.11 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:
1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify the operation of lockout or interlock systems.
4. Verify the operation of valve and damper actuators.
5. Verify that controlled devices are properly installed and connected to correct controller.
6. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
7. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.12 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets (other): Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 5 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.13 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.14 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
1.

2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Pipe and valve sizes and locations.
4. Balancing stations.
5. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.
2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Filter static-pressure differential in inches wg.
   f. Preheat-coil static-pressure differential in inches wg.
   g. Cooling-coil static-pressure differential in inches wg.
   h. Outdoor airflow in cfm.
   i. Return airflow in cfm.
   j. Outdoor-air damper position.
   k. Return-air damper position.
   l. Pressure set-point in inches wg.

F. Apparatus-Coil Test Reports:
1. Coil Data:
   a. System identification.
   b. Location.
   c. Coil type.
   d. Number of rows.
   e. Fin spacing in fins per inch o.c.
   f. Make and model number.
   g. Face area in sq. ft..
   h. Tube size in NPS.
   i. Tube and fin materials.
   j. Circuiting arrangement.
2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Average face velocity in fpm.
   c. Air pressure drop in inches wg.
   d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
   e. Return-air, wet- and dry-bulb temperatures in deg F.
   f. Entering-air, wet- and dry-bulb temperatures in deg F.
   g. Leaving-air, wet- and dry-bulb temperatures in deg F.
   h. Refrigerant expansion valve and refrigerant types.
   i. Refrigerant suction pressure in psig.
   j. Refrigerant suction temperature in deg F.

G. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
   a. System identification.
   b. Location.
   c. Make and type.
   d. Model number and size.
   e. Manufacturer's serial number.
   f. Arrangement and class.
   g. Sheave make, size in inches, and bore.
   h. Center-to-center dimensions of sheave and amount of adjustments in inches.
2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and rpm.

c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan rpm.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.
   f. Pressure set-point in inches wg.

H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
1. Report Data:
   a. System and air-handling-unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F.
   d. Duct static pressure in inches wg.
   e. Duct size in inches.
   f. Duct area in sq. ft..
   g. Indicated airflow rate in cfm.
   h. Indicated velocity in fpm.
   i. Actual airflow rate in cfm.
   j. Actual average velocity in fpm.
   k. Barometric pressure in psig.
2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Air velocity in fpm.
   c. Preliminary airflow rate as needed in cfm.
   d. Preliminary velocity as needed in fpm.
   e. Final airflow rate in cfm.
   f. Final velocity in fpm.
   g. Final calibration factor for achieving design air flow.
   h. Individual inlet and outlet readings and sum at maximum air flow rate and at minimum air flow rate in cfm.
   i. Space temperature in deg F.

I. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
   a. System and air-handling-unit identification.
   b. Location and zone.
   c. Room or riser served.
   d. Coil make and size.
2. Test Data (Indicated and Actual Values):
   a. Airflow rate in cfm.
   b. Entering-water temperature in deg F.
   c. Leaving-water temperature in deg F.

J. Instrument Calibration Reports:
1. Report Data:
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.15 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager and commissioning authority. Prepare test and inspection reports.

B. Verification of TAB will include 10% of all redundant equipment such as terminal units. Verification of TAB will include limited readings of 100% of major equipment (all AHUs, EFs, etc.).

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:
   1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
   2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
   3. If the second verification also fails, Owner may contact AABC Headquarters regarding the AABC National Performance Guaranty.

3.16 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION

SECTION 230713
DUCT INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, supply, return, exhaust and outside air.
2. Type I, commercial, kitchen hood exhaust.
3. Outdoor, exposed supply and return.

B. Related Sections:

1. Section 230719 "HVAC Piping Insulation."

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule" article for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation **with factory-applied FSK jacket**. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.02 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

2.03 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.04 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.

3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.05 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

2.06 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.07 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Metal Jacket:

1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Outdoor Applications: 3-mil-heat-bonded polyethylene and kraft paper.

2.08 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.09 SECUREMENTS

A. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
b. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

c. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.03 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

3.04 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.05 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating. Insulate duct access panels and doors to achieve same fire rating as duct.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

    1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to two location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.07 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

    1. Indoor, concealed supply, return, exhaust and outside air.
    2. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
    3. Outdoor, return.
    4. Outdoor, supply.

B. Items Not Insulated:

    1. Fibrous-glass ducts.
    2. Factory-insulated flexible ducts.
    3. Factory-insulated plenums and casings.

4. Flexible connectors.
5. Factory-insulated access panels and doors.

3.08 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Supply, Return, Exhaust and Outside-Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 2 inches thick and 0.75-lb/cu. Ft. nominal density.

B. Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket or board; thickness as required to achieve 2-hour fire rating.

3.09 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Exposed, rectangular, return and supply-air duct insulation shall be the following:

1. Mineral-Fiber Board: 3 inches thick and 3-lb/cu. ft. nominal density.

3.10 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. Ducts and Plenums, Exposed:

1. Aluminum, Stucco Embossed: 0.032 inch thick.

END OF SECTION

SECTION 230719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes insulating the following HVAC piping systems:
   1. Condensate piping.
   2. Refrigerant suction and hot-gas piping, indoors and outdoors.

B. Related Sections:
   1. Section 230713 "Duct Insulation."

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

PART 2 PRODUCTS

2.01 INSULATION MATERIALS

A. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials. Must be plenum-rated.

2.02 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

2.03 SEALANTS

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.

2.04 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

2.05 TAPES

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.02 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.03 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.04 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.05 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

3.06 INDOOR PIPING INSULATION SCHEDULE

A. Condensate Piping: Flexible Elastomeric: 1 inch thick.

B. Refrigerant Suction and Hot-Gas Piping: 1-1/2 inch thick.

3.07 OUTDOOR PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: 1-1/2 inch thick.

3.08 OUTDOOR, FIELD-APPLIED FINISH SCHEDULE

A. All outdoor exposed piping shall be painted with two coats of insulation manufacturer recommended protective finish. Prior to applying the finish, the insulation shall be wiped clean with denatured alcohol. The finish shall not be tinted. To ensure good adhesion, the temperature shall be above 50 °F during application and drying.

END OF SECTION

SECTION 232113
HYDRONIC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Condensate-drain piping.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of the following:
1. Pipe and fittings.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Condensate-Drain Piping: 150 deg F.

2.02 COPPER TUBE AND FITTINGS

A. DWV Copper Tubing: ASTM B 306, Type DWV.

B. Wrought-Copper Unions: ASME B16.22.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

2.03 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Description:
      a. Standard: ASSE 1079.
      b. Pressure Rating: 125 psig minimum at 180 deg F.
      c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.01 PIPING APPLICATIONS

A. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

3.02 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

M. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

N. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.03 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

3.04 HANGERS AND SUPPORTS

A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:
   1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
   2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
   3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
   4. Spring hangers to support vertical runs.
   5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
   1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
   2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
   3. NPS 1-1/4Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

D. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.05 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

END OF SECTION

SECTION 232300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.02 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines: 535 psig.
2. Hot-Gas and Liquid Lines: 535 psig.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.06 QUALITY ASSURANCE

A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.07 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

PART 2 PRODUCTS

2.01 COPPER TUBE AND FITTINGS

A. Provide as recommended by equipment by manufacturer.

2.02 VALVES AND SPECIALTIES

A. Provide as recommended by equipment by manufacturer.

2.03 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 EXECUTION

3.01 PIPING APPLICATIONS

A. Provide as recommended by equipment by manufacturer.

3.02 VALVE AND SPECIALTY APPLICATIONS

A. Provide as recommended by equipment by manufacturer.

3.03 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

L. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

M. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."

P. Install sleeves for piping penetrations of walls, ceilings, and floors.

Q. Install sleeve seals for piping penetrations of concrete walls and slabs.

R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.04 PIPE JOINT CONSTRUCTION

A. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

B. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.05 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections as recommended by equipment manufacturer and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.

3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    c. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.07 SYSTEM CHARGING

A. Charge system as recommended by equipment manufacturer.

END OF SECTION

SECTION 233113
DUCTWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Exterior prefabricated weathertight insulated ducts.
4. Sheet metal materials.
5. Sealant and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, duct-mounting access doors, turning vanes, and flexible ducts.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Exterior prefabricated weathertight insulated ducts.
2. Sealants and gaskets.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

PART 2 PRODUCTS

2.01 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.03 EXTERIOR PREFABRICATED WEATHERTIGHT INSULATED RECTANGULAR DUCTS:

A. Factory fabricated 2–inch thick, R-10, double layered duct system consisting of insulated phenolic duct panels assembled into interlocking sections.

B. Phenolic Duct Panels: Rigid Phenolic insulation panels with 3.4- 3.75 pcf nominal density CFC/HCFC-free rigid Phenolic insulation core, zero Ozone Depletion Potential (ODP), autohesively bonded on both sides, 60 micron solid aluminum internal liner, 200 micron solid aluminum external liner.

C. Exterior cladding: UL1709, 5 ply, flexible, puncture resistant, tear resistant.

D. Sealant: Manufacturer approved phenolic sealant/adhesive.

2.04 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

2.05 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
11. Service: Indoor or outdoor.
12. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.06 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:
1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.

PART 3 EXECUTION

3.01 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Where ducts pass through non-fire-rated interior partitions and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

K. Dust collection ductwork shall use no screws or other obstructions internal to the duct. Fabricate according to industry standards for industrial ventilation.

3.02 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.03 INSTALLATION OF EXTERIOR WEATHERTIGHT INSULATED RECTANGULAR DUCTWORK

A. Conform strictly to manufacturer’s instructions.

B. Seal internal seams with unbroken layer of phenolic sealant.

C. Connect interlocking duct sections with manufacturer’s double sealed jointing system.

D. Seal external seams with manufacturer’s tiger clips, taped and jacketed to shed water.

3.04 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.

C. Light test or an approved equivalent test method shall be performed to determine that all welded and brazed joints are liquid tight. A light test shall be performed by passing a lamp having a power rating of not less than 100 watts through the entire section of duct work to be tested. The lamp shall be open so as to emit light equally in all directions perpendicular to the duct walls. This test shall be performed prior to the use or concealment of any portion of a grease duct system.

3.05 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.06 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.07 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.08 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.09 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
   a. Test representative duct sections, selected by Architect from sections installed, totaling no less than 25 percent of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
   a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.10 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.11 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Supply Ducts:

1. Ducts Connected to Water-to-Air Heat Pumps:

a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round: 8.

C. Exterior Supply and Makeup Air Ducts:

1. Exterior Ducts Connected to Makeup Air Units:
a. Phenolic Panel Construction
b. Pressure Class: Positive 3-inch wg.
c. Minimum SMACNA Seal Class: A.

D. Return Ducts:

1. Ducts Connected to Water-to-Air Heat Pumps:
a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round: 8.

E. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round: 8.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
a. Exposed to View: Type 304, stainless-steel sheet, No. 3 finish.
b. Concealed: Type 304, stainless-steel sheet, No. 2D finish or Carbon-steel sheet.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 3-inch wg.
e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: 3.

3. Ducts Connected to Dishwasher:
a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 3 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

4. Ducts Connected to Dust Collection Systems
a. Pressure Class: Negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. Factory single-wall spiral round with no internal obstructions.

F. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Supply Ducts Connected to Heat Pumps:
a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round: 8.

2. Return Ducts Connected to Heat Pumps:
a. Pressure Class: Positive 2-inch wg.
b. Minimum SMACNA Seal Class: C.

c. SMACNA Leakage Class for Rectangular: 16.
d. SMACNA Leakage Class for Round: 8.

G. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

2. Stainless-Steel Ducts:
a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

H. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
a. Velocity 1000 fpm or Lower:
1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.
b. Velocity 1000 to 1500 fpm:
1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
c. Velocity 1500 fpm or Higher:
1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
1) Radius-to Diameter Ratio: 1.5.
b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

I. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
a. Velocity 1000 fpm or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm: Conical tap.

c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Manual volume dampers.
   2. Flange connectors.
   3. Turning vanes.
   4. Duct-mounted access doors.
   5. Flexible connectors.
   6. Flexible ducts.
   7. Duct accessory hardware.
   8. Dust Collection Duct Accessories

B. Related Section Includes:
   1. Section 283111 – Digital, Addressable Fire-Alarm System for duct-mounted fire and smoke detectors.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
   1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
      a. Fire-damper, combination fire- and smoke-damper including sleeves; and duct-mounted access doors and remote damper operators.
      b. Manual volume damper installations.
      c. Control-damper installations.
      d. Wiring Diagrams: For power, signal, and control wiring.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.05 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 PRODUCTS

2.01 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.02 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

B. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.03 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
   1. Standard leakage rating, with linkage outside airstream.
   2. Suitable for horizontal or vertical applications.
   3. Frames:
      a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   4. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized-steel, 0.064 inch thick.
   5. Blade Axles: Galvanized steel.
   6. Bearings:
      a. Molded synthetic.
      b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
   7. Tie Bars and Brackets: Galvanized steel.

2.04 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.05 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

B. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

C. Vane Construction: Single wall.

2.06 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
   1. Door:
      a. Double wall, rectangular.
      b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
      c. Vision panel.
      d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
      e. Fabricate doors airtight and suitable for duct pressure class.
   2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
   3. Number of Hinges and Locks:
      a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
      b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
      c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches.

2.07 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
   1. Minimum Weight: 26 oz./sq. yd..
   2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
   3. Service Temperature: Minus 40 to plus 200 deg F.

E. Insulated, Flexible Duct: UL 181, Class 1, multiple layers of aluminum laminate supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   2. Maximum Air Velocity: 4000 fpm.
   3. Temperature Range: Minus 20 to plus 210 deg F.

F. Flexible Duct Connectors:
   1. Clamps: Nylon strap in sizes 3 through 18 inches, to suit duct size.
   2. Non-Clamp Connectors: Liquid adhesive plus tape.

2.08 FLEXIBLE DUCTS

A. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   2. Maximum Air Velocity: 4000 fpm.
   3. Temperature Range: Minus 20 to plus 210 deg F.
   4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

2.09 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.10 DUST COLLECTION DUCT ACCESSORIES

A. Blast gates: 2-piece cast construction with fully adjustable sliding gate and set screw.

B. Flexible tubing: Fiberglass wire reinforced tubing with wear strip suitable for wood dust collection application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.
   1. Install steel volume dampers in steel ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. At outdoor-air intakes.
   2. At outdoor-air intakes and mixed-air plenums.
   3. Downstream from manual volume dampers.
   4. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
   5. Elsewhere as indicated.

G. Install access doors with swing against duct static pressure.

H. Access Door Sizes:
   1. One-Hand or Inspection Access: 8 by 5 inches.
   2. Two-Hand Access: 12 by 6 inches.
   3. Head and Hand Access: 18 by 10 inches.
   4. Head and Shoulders Access: 21 by 14 inches.
   5. Body Access: 25 by 14 inches.
   6. Body plus Ladder Access: 25 by 17 inches.

I. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

K. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

L. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

M. Connect diffusers to ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place. Connect flexible ducts to metal ducts with liquid adhesive plus tape and draw bands.

N. Install duct test holes where required for testing and balancing purposes.

O. Install dust collection duct accessories per accepted industrial ventilation standards and manufacturer recommendations.

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed.
   3. Inspect turning vanes for proper and secure installation.

END OF SECTION

SECTION 233423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Centrifugal roof ventilators.
   2. Wall Fans.
   3. Ceiling mounted.
   4. In-line.

1.02 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on sea level.

B. Operating Limits: Classify according to AMCA 99.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material thickness and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
   6. Roof curbs.
   7. Fan speed controllers.

1.04 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Belts: One set(s) for each belt-driven unit.

1.07 QUALITY ASSURANCE

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. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

C. UL Standards: Power ventilators shall comply with UL 705.

1.08 COORDINATION

A. Coordinate size and location of structural-steel support members.

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 PRODUCTS

2.01 FANS

A. Description: See drawings.

B. Capacities: See drawings.

C. Product Requirements:
   1. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.
   2. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.
   3. Fabrication: Conform to AMCA 99.
   4. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

D. Electrical Characteristics and Components
   1. Electrical Characteristics: See Drawings

E. Accessories:
   1. Roof curb: For roof mounted fans, provide matching galvanized steel curb with litered and welded corners, 1-1/2” rigid insulation on inside wall, 12 inched high, minimum, wind rated and be specific to the roof type. Backdraft damper: Provide matching backdraft damper for exhaust fans.

2.02 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.03 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install power ventilators level and plumb.

B. Equipment Mounting:
   1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

C. Secure roof-mounted fans to roof curbs with stainless steel hardware.

D. Install units with clearances for service and maintenance.

E. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.02 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 “Building Wire and Cable."

3.03 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 assist in testing.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Prepare test and inspection reports.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation. Adjust belt tension.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

C. Replace fan and motor pulleys as required to achieve design airflow. Lubricate bearings.

END OF SECTION

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Diffusers, registers, and grilles.

B. Related Sections:
   1. Section 089000 "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
   2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 PRODUCTS

2.01 DIFFUSERS, REGISTERS, AND GRILLES

A. Refer to schedule on design drawings for further information.

2.02 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 EXECUTION

3.01 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.02 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 233813
COMMERCIAL-KITCHEN HOODS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes Type I commercial-kitchen hoods.

1.02 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Filters/baffles.
   2. Fire-suppression systems.
   3. Lighting fixtures.

PART 2 PRODUCTS

2.01 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.

2.02 HOOD MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.
   1. Minimum Thickness: 0.050 inch.
   2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
      a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
   3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
   4. Exposed Surfaces: ASTM A 480/A 480M, No. 3 finish (intermediate polished surface).
   5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

B. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial-kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR 177.2600, for use in areas that come in contact with food.
   1. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.

C. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.03 GENERAL HOOD FABRICATION REQUIREMENTS

A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.

1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.
2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.

B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.

D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.

E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.

F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.

G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.

H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.

I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets unless otherwise indicated.

J. Fabricate seismic restraints according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," Appendix A, "Seismic Restraint Details."

K. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."

2.04 TYPE I EXHAUST HOOD FABRICATION

A. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
1. Fabricate hoods according to NSF 2, "Food Equipment."
2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
3. Hoods shall be designed, fabricated and installed according to NFPA 96.
4. Include access panels as required for access to fire dampers and fusible links.
5. Duct Collars: Stainless steel 4” long with 1” flange, continuously welded to top of hood and at corners.

B. Hood Configuration: See drawings.

C. Hood Style: Double-island canopy.

D. Filters/Baffles: See drawings.

E. Lighting Fixtures: See drawings.

F. Hood Controls: Hood-mounting control cabinet,fabricated of stainless steel.

2.05 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

A. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.
   1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
   2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
   3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on hood. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
   4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
   5. Furnish electric-operated gas shutoff valve; see Section 231123 "Facility Natural-Gas Piping."
   6. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
   7. Connect fire suppression system into central fire alarm system.
   8. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
   9. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

B. Complete field assembly of hoods where required.
   1. Make closed butt and contact joints that do not require filler.
   2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "General Hood Fabrication Requirements" Article.

C. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.

D. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.

E. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners unless otherwise indicated.

F. Install hoods to operate free from vibration.

G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainless-steel fasteners at 48 inches o.c. maximum.

H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.

I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.

J. Set initial temperatures, and calibrate sensors.

K. Set field-adjustable switches.

L. Connect ducts according to requirements in Section 233300 "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquid tight joint.

M. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Perform hood performance tests required by authorities having jurisdiction.
   4. Perform fire-suppression system performance tests required by authorities having jurisdiction.

B. Commercial-kitchen hoods will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.03 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial kitchen hoods.

END OF SECTION

SECTION 237433

DEDICATED OUTDOOR-AIR UNITS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes factory-packaged units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

1.03 ACTION SUBMITTALS

A. Submit unit performance data including: capacity, nominal and operating performance.

B. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

C. Submit shop drawings indicating overall dimensions as well as installation, operation and services clearances. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.

D. Submit data on electrical requirements and connection points. Include recommended wire and fuse sizes or MCA, sequence of operation, safety and start-up instructions.

E. Shop drawings submitted for approval shall be accompanied by a copy of the purchase agreement between the Contractor and an authorized service representative of the manufacturer for check, test and start up and first year service.

1.04 INFORMATIONAL SUBMITTALS

A. Startup service reports.

B. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For units to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fan Belts: One set for each belt-driven fan.
   2. Filters: One sets for each unit.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Five years from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product. Substitution must be approved by Engineer prior to bidding/pricing.

2.02 GENERAL UNIT DESCRIPTION

A. Unit(s) furnished and installed shall be packaged outdoor air unit (s) as scheduled on contract documents and these specifications. Unit(s) shall consist of insulated weather-tight casing with compressor(s), air-cooled condenser coil, condenser fans, evaporator coil, air filters, supply motors and unit controls.

B. Before shipment, each unit(s) shall be leak tested, dehydrated, charged with refrigerant (R-410A) and compressor oil, and factory run tested for proper control operation.

C. The condenser coils must be aluminum fin, mechanically bonded to copper tubing.

D. Direct-drive, vertical discharge condenser fans must be provided with built-in thermal overload protection.

E. Unit(s) shall have labels, decals, and/or tags to aid in the service of the unit and indicate caution areas.

F. Unit(s) shall be dedicated downflow or dedicated, thru curb horizontal airflow as manufactured.

G. Wiring internal to the unit shall be colored and numbered for identification.

2.03 UNIT CASING

A. Cabinet: Zinc-coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 672 hours in a salt spray test in compliance with ASTM B45. Structural members shall be a minimum of 16 gauge with access doors and removable panels of minimum 20 gauge.

B. Panels: 2" double-wall foamed panel construction throughout the indoor section of unit to provide nonporous, cleanable interior surfaces. All interior seams exposed to airflow shall be sealed.

C. Insulation: 2" polyisocyanurate Foam metal encapsulated with no exposed edges. Initial R value of 6.6 per inch of thickness.

D. Cabinet construction shall provide access panels for all parts requiring service.

E. Cabinet top cover shall be one piece construction or where seams exist, it shall be double-hemmed and gasket-sealed.

F. Panels: Water- and air-tight hinged panels with handles shall provide access to filters, heating section; optional ERV and power exhaust fan section, supply air fan section, evaporator coil section, and unit control section. Door hardware shall be oriented to allow the door swing to be reversed.
   1. Latches with hold down hooks will be factory installed on hinged access doors.

G. Unit shall include a motor operated outside air damper and optional return air damper assembly constructed of galvanized steel, and air foil blades with rubber edge seals. Damper blades shall be designed to have no more than 4 cfm of leakage per sq. ft of damper area and shall exceed ASHRAE 90.1 requirements. Linkage shall be concealed out of airstream, within the damper frame to reduce pressure and noise. Damper assembly shall be controlled by a spring return two position or fully modulating actuator. Dampers shall not be sized for air velocities exceeding 2000 fpm.

H. Type 304 Stainless steel drain pan sloped in two directions to ensure positive drainage. Pan shall have a minimum depth of 2". Seams exposed to standing water shall be welded liquid tight. Base of pan shall be insulated with 1" thick foam insulation.

I. Provide openings either on side of unit or thru the base for power, control and gas connections.

J. Optional corrosion inhibiting coatings available for the unit exterior, interior and coils. Interior liner 304 stainless with seams sealed with caulk.

K. Coil Coating: Coil will have a flexible epoxy polymer e-coat uniformly applied to all coil surface areas with no material bridging between fins. The coating process will ensure complete coil encapsulation and a uniform dry film thickness from 0.6 – 1.2 mills on all surface areas including fin edges and meet 5b rating cross hatched adhesion per ASTM B3359- 93 Corrosion durability will be confirmed through testing with no less than 5,000 hours salt spray resistance per ASTM B117-90 using scribed aluminum test school coupons. The coil coating will meet the following test standards:

1. MIL-C-46168 Chemical Agent Resistance – DS2, HCL Gas

2. CIDA-A-52474-A (GSA)

3. MIL-STD810F, Method 509.4 (Sand and Dust)

4. MIL-P-53084 (ME)-TACOM Approval

5. MIL-DTL-12468 Decontamination Agent (STB)

6. DPG (Dugway Proving Grounds) Soil & Water Exposure Tests

7. GM9540P-97 Accelerated Corrosion Test (120 cycles)

8. ASTMB117-G85 Modified Salt Spray (Fog) Testing-2,000 hours (tested by ARL for Lockheed Martin)

L. The unit(s) must comply per above - spray coatings not acceptable

M. The base of the unit shall have provisions for forklift and crane lifting

2.04 POWER WIRING

A. Field wiring access to be provided thru unit base into isolated enclosure with removable cover.

B. Power wiring to be single point connection.

C. Unit shall be factory wired to field wiring terminal block mounted in isolated enclosure.

D. Factory installed safety barrier shall isolate all high voltage components, mounted inside electrical compartment, to protect service personnel from incidental contact.

E. Factory wired Phase monitor shall be included as standard.

2.05 LOW VOLTAGE CONTROLS

A. Factory wired 24-volt control system complete with required transformers and fusing.

B. Main Control Module (MCM) shall prevent simultaneous operation of any modes and shall enable operation in Dehumidification, Cooling, Heating or Economizer mode based on programmed settings for (select one)

1. Outdoor air conditions and discharge air temperature

C. MCM shall accept separate setpoints for Occupied and Unoccupied states.

D. MCM shall control based on dew point design settings for Dehumidification and Economizer modes, and sensible temperature settings for heating and cooling modes.

E. MCM shall have onboard clock and scheduling function for occupancy.

F. MCM shall include non-volatile memory to retain all programmed values without the use of a battery, in the event of a power failure.

G. Factory installed and wired sensors shall monitor Outdoor Air (OA) temperature, humidity and evaporator leaving air temperature.

H. Supply air sensor shall be furnished with unit. Installing contractor shall install remote mounted supply air sensor in supply air duct and field wire to the unit.

I. Space temp and humidity sensor shall be furnished and field wired to unit by the installing contractor.

J. Fully modulating hot-gas reheat shall be enabled in dehumidification mode and cooling mode with modulation controlled by MCM to maintain (supply air temperature / space temperature).

K. System controls shall include anti-cycle timing and minimum compressor run/off-times.

L. Systems controls shall be digital, programmable type with access via factory installed and wired touchscreen, or through portable computer connection. All setpoints, unit functions, and status shall be accessible via the touchscreen or portable computer.

M. Factory wired (return air / supply air) smoke detector(s)

N. All low voltage field wiring connections shall be made at factory installed low voltage terminal strip.

2.06 FANS AND MOTORS

A. Indoor fans shall be high efficiency backward curved impeller.

B. The indoor fan motor shall be an electronic commutated motor with integrated power electronics for variable motor speed.

C. All fan motors shall be premium efficiency ODP and meet the U.S. Energy Policy Act of 2005/10 (EPACT).

D. All fan motors shall either be permanently lubricated and/ or have internal thermal overload protection.

E. Outdoor fans shall be direct drive with premium efficiency motors, statically and dynamically balanced, draw through in the vertical discharge position.

F. Provide shafts constructed of solid hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.07 MODULATING ELECTRIC HEATING SECTION

A. The unit(s) may have fully modulating, SCR controlled, electric heat. The primary heating section will include finned tubular heating elements, automatic and manual cut-outs, low voltage controls, air proving switch, maximum 48 amps per circuit and fusing for heaters over 48 amps.

B. Heater shall be internal to unit cabinet and downstream of the evaporator fan.

C. Heater shall be UL or CSA listed and approved and provide single point power connection.

2.08 EVAPORATOR CONDENSER AND REHEAT COILS

A. Evaporator and hot gas reheat coils shall be constructed of copper tubes mechanically bonded to a configured aluminum plate fin.

B. Coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil, reheat coil and condenser coil shall be leak tested to 500 psig and pressure tested to 500 psig.

C. The condenser coil shall have a fin designed for ease of cleaning.

D. Evaporator coil shall have four interlaced rows for superior sensible and latent cooling with a maximum of 12 fpi.

E. Reheat coil shall be fully integrated into the supply air and fan system and capable of delivering design supply air temperature.

F. To prevent re-hydration of condensate from evaporator coil, the evaporator coil face and the hot gas reheat coil face shall be separated a minimum of six inches.

G. Condenser coil shall be provided with factory installed hail guards.

H. Unit shall be equipped with an adjustable 6” filter rack upstream of the evaporator to match the filter requirements specified in the Air Filtration section

2.09 CONDENSER SECTION

A. Outdoor Fans: vertical discharge, direct drive fans constructed of glass reinforced polypropylene blades. Fans shall be low-noise and corrosion resistant. Another fan construction is not acceptable.

B. Fans shall be statically balanced.

2.10 REFRIGERANT CAPACITY CONTROL

A. Capacity control for units equipped with digital scroll compressors, or variable speed compressors, shall be accomplished through a 0-10V signal by the MCM to the compressor controls.

2.11 REFRIGERATION SYSTEM

A. Compressor(s): All units shall have direct-drive, hermetic, scroll type compressors.

B. Motor shall be suction gas-cooled and shall have a voltage utilization range of plus or minus 10 percent of unit nameplate voltage.

C. Internal overloads shall be provided with the scroll compressors.

D. Each compressor shall have a crankcase heater to minimize the amount of liquid refrigerant present in the oil sump during off cycles.

E. Each compressor shall be mounted on rubber vibration isolators, to reduce the transmission of noise.

F. Provide each unit with hermetically sealed refrigerant circuit(s) factory-supplied completely piped with liquid line filter-drier, liquid line charging port, discharge, suction and liquid line pressure ports, sight glass, thermal expansion valve, 4-way reversing valve, suction line accumulator, and charge compensator.

G. Provide each circuit with automatic reset high- and low-pressure switches for safety control.

2.12 POWER EXHAUST/RETURN SECTION

A. Provide, a factory installed power exhaust assembly that shall be designed to ventilate return air to atmosphere.

B. Fan wheel shall be direct drive plenum fan, factory installed and wired to on-board Variable Frequency Drive. Another fan construction is not acceptable

C. Fan mount to be fixed.

D. Exhaust to ventilate through automatic louver located on both sides of unit cabinet.

2.13 BUILDING MANAGEMENT SYSTEM

A. Interface control module to Energy Management System to be furnished and mounted by unit manufacturer. Through this interface module, all Energy Management functions (specified in Energy Management Section) shall be performed. See Building Automation and Automatic Temperature Control System Specifications. The interface module with necessary controls and sensors shall all be factory mounted (not field mounted). The only field connection to Energy Management System shall be two wire communication link.

B. Control Functions: Occupied/unoccupied mode, conditioning mode set points, discharge air set point adjustment, and alarm shutdown.

C. Diagnostic Functions: Include supply fan status, filter status, outside air damper status.

D. Provide capabilities for Boolean Processing and trend logs as well as "templated" reports and logs.

PART 3 EXECUTION

3.01 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 piping, ducts, and electrical systems to verify actual locations of connections before equipment installation.

C. Examine roof curbs and equipment supports for suitable conditions where units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.

B. Curb Support: Install roof curb on roof structure according to "The NRCA Roofing Manual."
   1. Install and secure units on curbs and coordinate roof penetrations and flashing with roof construction.
   2. Coordinate size, installation, and structural capacity of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."
   3. Coordinate size, location, and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.

C. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.

D. Install separate devices furnished by manufacturer and not factory installed.

E. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

F. Install drain pipes from unit drain pans to roof drains. Provide manufactured roof pipe supports for condensate piping. Piping supports shall be designed specifically for support of condensate piping systems. Supports shall be UV resistant and suitable for installation on roofing material. Supports must comply with NCPC 301.10 for wind speeds up to 145 MPH.
   1. Drain Piping: Schedule 40 PVC pipe complying with ASTM D 1785, with solvent-welded fittings.
   2. Pipe Size: Same size as condensate drain pan connection.

3.03 CONNECTIONS

A. Where installing piping adjacent to units, allow space for service and maintenance.

B. Duct Connections:
   1. Comply with requirements in Section 233113 "Metal Ducts."
   2. Drawings indicate the general arrangement of ducts.
   3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 233300 "Air Duct Accessories."

C. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Sections.
   1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.04 FACTORY VERIFICATION TESTING

A. Unit shall be run tested prior to shipment from the factory.

B. Factory run test report shall be provided at the request of the engineer, contractor, or owner.

C. Testing Procedures
   1. Unit shall be subjected to and pass a dielectric (hipot) test.
   2. All motorized dampers shall be cycled one full stroke while installed in the unit using the factory-provided motorized actuators.
   3. Supply fan
      a. Visually inspect ramp-up, ramp-down, and rotation direction of fan when enabled.
      b. Verify fan pressure proving switch operation.
      c. Measure and record current draw through supply fan motor(s).
   4. Exhaust fan
      a. Visually inspect ramp-up, ramp-down, and rotation direction of fan when enabled.

b. Verify fan pressure proving switch operation.
c. Measure and record current draw through exhaust fan motor(s).

5. Energy recovery wheel.
   a. Visually inspect energy recovery wheel cassette is free to rotate within cassette.
   b. Visually inspect energy recovery belt drive mechanism.
   c. Enable energy recovery wheel motor and ensure proper rotation.
   d. Measure and record current draw through energy recovery wheel motor.
6. Condensing fans
   a. Ensure fans rotate freely without obstruction.
   b. Energize fans and ensure proper rotation.
   c. Measure and record the amount of current draw through each condensing fan.
7. Refrigeration system
   a. Measure and record subcooling and superheat on circuit A with hot-gas reheat valve closed (0%) after 15 minutes of steady-state operation.
   b. Measure and record subcooling and superheat on circuit A with hot-gas reheat valve open (100%) after 15 minutes of steady-state operation.
   c. Measure and record subcooling and superheat on circuit B after 15 minutes of steady-state operation.
   d. Test report shall be included with unit and available from the factory upon request.

D. Test report shall be included with unit and available from the factory upon request.

3.05 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. Inspect units for visible damage to furnace combustion chamber.
3. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:
   a. High-limit heat exchanger.
   b. Alarms.
4. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
5. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:
   a. Cooling coil leaving-air, dry- and wet-bulb temperatures.
   b. Cooling coil entering-air, dry- and wet-bulb temperatures.
   c. Condenser coil entering-air dry-bulb temperature.
   d. Condenser coil leaving-air dry-bulb temperature.
6. Simulate maximum cooling demand and inspect the following:
   a. Compressor refrigerant suction and hot-gas pressures.
   b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.
7. Inspect casing insulation for integrity, moisture content, and adhesion.
8. Verify that clearances have been provided for servicing.
9. Verify that controls are connected and operable.
10. Verify that filters are installed.
11. Clean coils and inspect for construction debris.
12. Clean furnace flue and inspect for construction debris.
13. Inspect operation of power vents.
14. Verify bearing lubrication.
15. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
16. Adjust fan belts to proper alignment and tension.
17. Start unit.
18. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
19. Operate unit for run-in period.

20. Calibrate controls.
21. Adjust and inspect high-temperature limits.
22. Verify operational sequence of controls.
23. Measure and record the following airflows. Plot fan volumes on fan curve.
    a. Supply-air volume.
    b. Return-air flow.
    c. Outdoor-air flow.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.06 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months from 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.

3.07 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

PART 4 SEQUENCE OF OPERATION

4.01 DEDICATED OUTDOOR AIR UNITS (DOAS)

A. Microprocessor controller - Each DOAS shall be controlled by a stand-alone microprocessor-based controller with resident control logic. The controller will interface with the BAS (BACNET or Lonworks) and the inputs and outputs in the points list to accomplish the following temperature control and energy conservation strategies.
    1. Occupied Discharge Air Control Mode - All unit functions will be enabled for normal heating and cooling operation to maintain supply air heating /cooling discharge air setpoints. Unit defaults to default temperature setpoints in the unit microprocessor when communication with BAS is lost.

B. Low Ambient Compressor Lockout - Compressor operation shall be disabled below a user defined outdoor air temperature.

C. Unit status report - For each DOAS unit, the BAS shall provide an operating status summary of all sensed values (zone temperature, discharge temperature, etc.) setpoints and modes.

D. Supply Air Tempering - When the unit is in the heat mode, but not actively heating, outdoor air heat set point will continue heat operation to maintain a minimum discharge air heating temperature setpoint and prevent heater cycling.

END OF SECTION

SECTION 238119.11

FLOOR-MOUNTED SELF-CONTAINED AIR-CONDITIONERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes packaged, air-cooled air-conditioning units with refrigerant compressors and controls intended for indoor installations.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: 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. Wiring Diagrams: For power, signal, and control wiring.

C. Training Agenda and Schedule.

1.04 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For self-contained air conditioners to include in emergency, operation, and maintenance manuals.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Filters: One set of filters for each unit.
   2. Fan Belts: One sets of belts for each unit.
   3. Gaskets: One set(s) for each access door.
   4. Condensate anti-microbial pan strips: 2 strips for each unit.

1.07 QUALITY ASSURANCE

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. ARI Compliance:
   1. Applicable requirements in ARI 210/240.

C. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

1.08 COORDINATION

A. Coordinate sizes and locations of exterior wall openings with actual equipment provided.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of self-contained air conditioners that fails in materials or workmanship within specified warranty period.
   1. Warranty Period:
      a. For Compressor: Five (5) years from date of Substantial Completion.
      b. For Parts: Five (5) years from date of Substantial Completion.
      c. For Labor: Five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
   1. Bard Manufacturing Company (Basis of Design).
   2. Marvair.
   3. Eubank.

2.02 PACKAGED UNITS

A. Description: Factory assembled, wired, and tested; and fully charged with refrigerant and oil.

B. Configuration: Vertical, floor mounted; vertical ducted discharge. Provide side piece trim extensions.

C. Disconnect Switch: Factory mounted on cabinet.

2.03 CABINET

A. Constructed of 20 gauge pre-painted steel exterior finish. Exterior panels shall be of double wall construction for enhanced acoustical sound absorption. Color options available. See Section 7.0 Cabinet Finish Options. Front panel is hinged and lockable for filter service and access to primary functional electrical controls. Front and side panels are easily removable for separation of top and bottom sections. Back of unit to be painted in neutral color to reduce visibility from outdoors. Provide custom trim pieces as necessary for a complete, neat installation.

2.04 TRIM

A. Provide manufacturers standard trim or custom trim per as required for an installation satisfactory to Engineer, Architect and Owner.

2.05 INSULATION

A. No fiberglass insulation shall be exposed to the airstream. Exterior cabinet components shall consist of double wall construction with insulation between panels.

2.06 COMPRESSOR

A. All interior installed models shall use a high efficiency 2-stage heating & cooling scroll compressor for maximum efficiency and reliability. The refrigeration circuit shall be equipped with factory installed high and low pressure controls, liquid line filter dryer, and discharge muffler. The compressor shall be mounted on double floating isolation mounting system and be fitted with sound attenuation jacket. The refrigeration control shall be a factory installed TXV. Heating and cooling TXV shall be provided. Refrigerant shall be R-410A.

2.07 CONDENSATE DRAIN SYSTEM

A. Condensate shall be removed from the unit by connections located in the back of the unit as indicated on plans. The evaporator and condenser coils shall have separate drain pans constructed of molded plastic. The lower unit base shall serve as a secondary drain pan. Provide condensate pan float switch to de-energize the unit upon condensate blockage. Provide model Hydro-Balance CS-250 anti-microbial chemical strip in each drain pan to protect build-up of algae, fungus and other micro-organisms.

2.08 CONDENSER FAN MOTOR

A. The condenser fan motor shall be variable speed ECM, allowing for modulating low ambient control and low sound performance.

2.09 INDOOR BLOWER MOTOR

A. The indoor blower motor shall be a variable speed (ECM) type. The motor shall be self-adjusting to provide proper rated air flow at static pressures without user adjustment or wiring changes by the user. The motor shall be programmed for 20-second ramp up and 60-second down rate for quiet, smooth starting and stopping. PSC motor shall not be acceptable.

2.10 ELECTRICAL COMPONENTS

A. Electrical components shall be accessible through front service panels. Unit shall have single point entry for line voltage.

2.11 CONTROL CIRCUIT

A. The internal control circuit shall consist of a current limiting 24VAC type 65VA transformer with circuit breaker. The defrost circuit shall consist of a solid state electronic heat pump control. A 30-minute timer shall inflate a defrost cycle if the outdoor coil temperature indicates the possibility of an iced condition. The thermistor sensor, speed-up terminal for service, and a ten-minute defrost override shall be all be standard on the electronic heat pump control. To prevent rapid compressor short cycling, a five-minute time delay circuit shall be factory installed. A low pressure bypass shall be factory installed to prevent nuisance tripping during low temperature start-up.

B. All units with 3-phase power shall include factory mounted phase rotation monitor. This device shall protect scroll compressor from reverse rotation and also protect unit from phase failure. If 3-phase power is incorrectly connected at the field power connections, the phase monitor shall lock out the unit and a red light will illuminate indicating incorrect phase. Also if a power leg is lost, the phase monitors will lockout the unit due to phase imbalance. Once the condition is corrected, turning the power off at the circuit breaker or disconnect will reset the phase monitor.

2.12 AUXILIARY HEAT

A. The heat pump shall have a factory installed electric resistance heater. Heater shall include automatic limit safety controls.

2.13 SERVICE FEATURES

A. The unit shall include a diagnostic light to indicate when service is required. System Service shall detect high or low pressure control operation.

2.14 VENTILATION OPTION

A. Commercial Room Ventilator (CRV): Factory installed commercial room ventilator shall be internally mounted allowing outside ventilation air introduced through the air inlet openings. Includes a built-in exhaust air damper. Positive shutoff of intake and return air path is required. The airflow rate shall be adjustable to meet scheduled values. The CRV shall be controlled by DDC Ventilation Schedule. Unit shall comply with ANSI/ASHRAE Standard 62.1 Ventilation for Acceptable Air Quality.

2.15 FILTER

A. 2" Fiberglass – Pleated – MERV 8.

2.16 HOT GAS REHEAT

A. The factory installed dehumidification circuit shall incorporate an independent heat exchanger coil in the supply air stream in addition to the standard evaporator coil. This coil reheats the supply air after it passes over the cooling coil, and is sized to nominally match the sensible cooling capacity of the evaporator coil. Models that also have electric heaters installed have the electric heat inhibited during dehumidification mode, although it remains available for additional reheat during certain conditions. The dehumidification cycle shall be energized by a rise in relative humidity above set point. The unit shall energize in the cooling mode and also a two position valve will energize, allowing hot refrigerant gas to pass thru the reheat coil, reheating the cold air leaving the evaporator coil. The dehumidification cycle shall have on/off capability. If the thermostat calls for cooling or heating during the dehumidification cycle, the unit shall drop out of dehumidification to satisfy the call from the thermostat. A solid state circuit board shall control the dehumidification function. The dehumidification option shall be factory installed.

2.17 CONTROLS

A. Controls will be provided and installed by DDC System contractor to operate unit for its intended sequence of operation.

B. Units shall be provided with low-ambient cooling.

C. Overflow float switch: Single point detection system shall be installed on condenser drain pan that will signal alarm to DDC system and de-energize system.

2.18 ACCESSORIES

A. Wall sleeve shall be factory supplied and be constructed of galvanized steel, coated with an epoxy primer and baked-on polyester enamel paint. It shall be designed to withstand a minimum of 1000 hours of salt spray protection when tested per ASTM B117-03 standard. Sleeve shall be sized to match unit size and wall depth.

B. Provide factory 2" Architectural louver designed for condenser air and outside air intake and exhaust. Louver shall be aluminum construction. Louver shall have finish matching curtain wall. Coordinate with Architect and General Contractor.

C. Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

2.19 CAPACITIES AND CHARACTERISTICS

A. Refer to Self-Contained Air-Conditioner Schedule on design drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install unit level and plumb.

B. Anchor units to structure.

3.02 CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

B. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply ducts to self-contained air conditioners with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.03 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. Unit coils and condensate drain system shall be cleaned at substantial completion.

C. 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.

D. Tests and Inspections:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation, and inspect for refrigerant leaks.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Units will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.04 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

3.05 DEMONSTRATION

A. Refer to Section 017900 – “Demonstration and Training.”

B. Completion of this training is a prerequisite for Substantial Completion.

3.06 SEQUENCE OF OPERATION

A. Refer to Mechanical Drawings.

3.07 POINTS LIST

A. Refer to Mechanical Drawings.

END OF SECTION

SECTION 238126

SPLIT-SYSTEM HEAT PUMPS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes split-system heat pumps, and auxiliary electric heater consisting of separate evaporator-fan and compressor-condenser components.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: 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.

C. Training Agenda and Schedule.

D. Operation and maintenance data.

E. Warranty: Sample of special warranty.

1.03 QUALITY ASSURANCE

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. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

1.04 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 PRODUCTS

2.01 INDOOR UNITS

A. Basis-of-Design Product: Refer to schedule on design drawings for basis of design.

2.02 OUTDOOR UNITS

A. Basis-of-Design Product: Refer to schedule on design drawings for basis of design.

2.03 ACCESSORIES

A. Refer to schedules on design drawings.

B. Condensate-Drain Piping: Schedule 40 PVC plastic pipe and fittings and solvent-welded joints.

2.04 CAPACITIES AND CHARACTERISTICS

A. Refer design drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install unit(s) level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

3.02 CONNECTIONS

A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Division 23 Section "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Division 23 Section "Air Duct Accessories."

3.03 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.04 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.05 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

B. Completion of this training is a prerequisite for Substantial Completion.

END OF SECTION

SECTION 239119
FIXED LOUVERS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes fixed, extruded-aluminum louvers.

1.02 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.

1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on tests performed according to AMCA 500-L.

PART 2 PRODUCTS

2.01 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Refer to equipment schedule on design drawings.

PART 3 EXECUTION

3.01 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.

3.02 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

SECTION 260500
GENERAL ELECTRICAL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Instructions to Bidders, General Conditions of the Contract, Supplementary General Conditions and Division 1 bound herewith are a component part of this Division of the specifications and MUST apply to this Division with equal force and MUST be consulted in detail for instructions pertaining to the work.

B. Furnish all labor, materials and equipment and incidentals required to make ready for use complete electrical systems as shown on the Drawings and specified herein.

C. It is the intent of these Specifications that the electrical systems MUST be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Division MUST be furnished at no extra cost.

D. The work MUST include, but not be limited to, furnishing, coordinating, and installing the following:

1. Electrical distribution system for power and miscellaneous power as shown on the contract drawings.
2. Grounding.
3. Other special requirements and/or systems where shown.

E. Each bidder (or Representative) MUST, before preparing a proposal, visit all areas of the existing site. If the work includes demolition, restoration, renovation and/or addition; then existing buildings and structures should be carefully inspected. The submission of the proposal by this Bidder MUST be considered evidence that the Bidder (or Representative) has visited the site and noted the locations and conditions under which the work will be performed and that the Bidder takes full responsibility for a complete knowledge of all factors governing the work.

F. All power interruptions to existing equipment MUST be at the Owner's convenience with 72 hours (minimum) notice. Each interruption MUST have prior approval. All equipment must remain operational during construction. All outages must minimize outage duration.

G. The work MUST include complete testing of all equipment and wiring at the completion of work and making any minor correction changes or adjustments necessary for all the proper functioning of the system and equipment. All work MUST be of the highest quality; substandard work will be rejected.

H. Field verify all existing underground electrical and mechanical piping.

1.02 SUBMITTALS

A. Shop drawings MUST be submitted for all equipment, apparatus, and other items as required by the Engineer. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections

B. Submittals are required for all materials shown in the individual specifications sections.

C. Submittals are required for materials used for penetrations of rated assemblies and for seismic restraints.

D. All shop drawings and submittals MUST be submitted at the same time. Partial shop drawing and submittals will be rejected and not processed. Materials, equipment and long lead items that require special handling, if identified and requested by the contractor, will be processed separately.

E. Proposed equipment and/or materials substitutions MUST be clearly indicated in shop drawings. All deviations from the specified quality, functionality, appearance or performance of the proposed equipment and/or materials MUST be clearly summarized in the preface of each submittal.

F. The project MUST be bid based on the equipment listed in these specifications and on the drawings. After award of the Electrical Contract the Contractor may wish to substitute equipment other than that specified, subject to approval. The Electrical Contractor MUST bear the "burden of proof" for demonstrating substitute equipment equivalency and suitability.

G. The Electrical Contractor MUST be required to replace installed "equivalent" equipment if the operation of this equipment does not meet the full design intent of the specified system.

H. Physical size of equipment used in the design layout are those of reputable equipment manufacturers. The Contractor is responsible for providing equipment which will fit the space provided. If the Contractor elects to use other manufacturer's equipment, any resulting conflicts with space clearance or codes MUST be the responsibility of the Contractor to correct at the Contractor's expense.

I. The Contractor assumes all responsibility for providing code clearances. Submit a scale drawing of each electrical equipment room showing exact size and location of all proposed electrical equipment with code clearances and working space clearly indicated.

1.03 COORDINATION OF WORK

A. It is understood and agreed that the Contractor is, by careful examination, satisfied 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 MUST 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 MUST compare the electrical drawings and specifications with the drawings and specifications for other trades, and MUST report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the electrical work. The electrical work MUST be installed in cooperation with other trades installing interrelated work. Before installation, the Contractor MUST make proper provisions to avoid interferences in a manner approved by the Engineer. All changes required in the work of the Contractor caused by neglect to do so MUST be made at the expense of the Contractor.

C. Location of electrical raceways, switches, panels, equipment, fixtures, etc., MUST be adjusted to accommodate the work to interferences anticipated and encountered. The Contractor MUST determine the exact route and location of each electrical raceway prior to make up and assembly.

1. Right of Way: Lines which pitch MUST have the right of way over those which do not pitch. For example, steam, condensate and plumbing drains MUST normally have right of way. Lines whose elevations cannot be changed MUST have the right of way over lines whose elevations can be changed.
2. Offsets and changes in direction of electrical raceways MUST be made as required to maintain proper headroom and to clear pitched lines whether or not indicated on the drawings. The Contractor MUST 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 or piping which cannot be resolved otherwise, will be resolved by the Engineer.

D. Installation and Arrangements: The Contractor MUST install all electrical work to permit removal (without damage to other parts) of any equipment requiring periodic replacement or maintenance. The Contractor MUST 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.

1.04 EQUIPMENT AND MATERIALS (GENERAL)

A. In compliance with North Carolina General Statute 133.3, the Engineer has, wherever possible, specified the required performance and design characteristics of all materials utilized in this construction. In some cases it is impossible to specify the required performance and design characteristics and when this occurs the Engineer has specified three or more examples of equal design or equivalent design, establishing an acceptable range for items of equal or equivalent design. Cited examples are used only to denote the quality standard of product desired and do not restrict bidders to a specific brand, make, manufacturer or specific name and are used only to set forth and convey to bidders the general style, type, character and quality of product desired. Equivalent products will be acceptable.

B. Substitution of materials, items, or equipment of equal or equivalent design MUST be submitted to the Engineer for approval or disapproval. Equal or equivalent MUST 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 Engineer being the judge of equality.

C. The materials used in all systems MUST be new, unused and as hereinafter specified and MUST bear the manufacturer's name, trade name and UL label in every case where a standard has been established for the particular material. Equipment furnished under this specification MUST be essentially the standard product of manufacturers regularly engaged in the production of the required type of equipment, and MUST be the manufacturer's latest approved design. All materials where not specified MUST be of the very best of their respective kinds. Samples of materials or manufacturer's specifications MUST be submitted for approval as required by the Engineer.

D. Protection: Electrical equipment MUST at all times during construction be adequately protected against damage. Equipment MUST be tightly covered and protected against dirt, water and chemical or mechanical injury and theft. Electrical equipment MUST not be stored out-of-doors. Electrical equipment MUST be stored in dry, permanent shelters. If an apparatus has been damaged, such damage MUST be repaired at no additional cost. If any apparatus has been subject to possible injury by water, it MUST be replaced at no additional cost to the Owner. At the completion of the work, fixtures, equipment, and materials MUST be cleaned and polished thoroughly and turned over to the Owner in a condition satisfactory to the Engineer. Damage or defects, developing before acceptance of the work MUST be made good at the Contractor's expense.

E. Any damage to factory applied paint finish MUST be repaired using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section MUST be repainted per the field painting specifications in Division 9, at no additional cost to the Owner.

F. Where materials such as wiring devices and plates, fire alarm equipment, paging system components, etc. are specified to match existing, provide materials to match existing equipment in finish, color, capacity, ratings, operating characteristics, performance, etc.

G. Delivery and Storage: Equipment and materials MUST 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.

H. Equipment and materials of the same general type MUST be of the same make throughout the work to provide uniform appearance, operation and maintenance.

I. Manufacturer's directions MUST be followed completely in the delivery, storage, protection, and installation of all equipment and materials. The Contractor MUST promptly notify the Engineer, in writing, of any conflicts between any requirements of the Contract Documents and the manufacturer's directions and MUST obtain the Engineer's written instructions before proceeding with the work. Should the Contractor perform any work that does not comply with the manufacturer's direction or such written instructions from the Engineer, the Contractor MUST bear all costs arising in correcting the deficiencies.

1.05 OPERATION AND MAINTENANCE MANUALS

A. Submit under relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. The Contractor MUST provide two compilations of catalog data, bound in suitable loose leaf binders, for each manufactured item of equipment used in the electrical work. These MUST be presented to the Engineer for transmittal to the Owner before the final inspection is made. Data MUST include printed installation, operation and maintenance instructions for each item, indexed by product with heavy sheet dividers and tabs. All warranties MUST be included with each item. Each manufacturer's name, address and telephone number MUST be clearly indicated.

C. Shop drawings with Engineer's "as noted" markings are not acceptable for the above. "Approved" shop drawings are acceptable if adequate information is contained therein. Generally, shop drawings alone are not adequate.

1.06 PAINTING

A. Any painting required due to electrical work or electrical demolition work MUST be performed by the Electrical Contractor.

B. Conductors exposed in boxes and cabinets MUST be protected against painting. Devices, cover plates, trims, etc., for panelboards and cabinets MUST not be installed until painting has been completed.

C. The Electrical Contractor MUST be responsible for touch up painting that may be required for electrical material or apparatus furnished with factory applied finish.

1.07 LOCATIONS AND MEASUREMENTS

Outlets and appliances are shown and located on the drawings as accurately as possible. All measurements MUST be verified on the project and in all cases the work MUST suit the surrounding trim, finishes and/or construction. The locations of outlets for special appliances MUST be installed so that when extended, they are flush with the finished wall or ceiling and permit the proper installation of fixtures and/or devices. Heights of all outlets shown on the drawings are approximate only. Slight relocations of outlets, devices and equipment MUST be made by the Contractor as required or as directed by the Engineer at no additional cost to the Owner.

1.08 QUALITY OF WORK

All work MUST be executed as required by this specification and the accompanying drawings and MUST be done by skilled mechanics, and MUST present a neat, trim, and mechanical appearance when completed. All work MUST be performed as required by the progress of the job.

1.09 SUPERVISION

A. The Contractor MUST personally, or through an authorized and competent representative, constantly supervise the work from the beginning to completion and final acceptance. So far as possible, the Contractor MUST keep the same foreman and mechanics throughout the project duration.

B. During the progress of the work it MUST be subject to inspection by representatives of the Engineer, the Owner, and local inspection authorities, at which time the Contractor MUST furnish such required information and data on the project as requested.

C. The Electrical Contractor MUST coordinate the electrical work with other Contractors and cooperate in the preparation and maintenance of a master schedule for the completion of the project.

1.10 CLOSING IN WORK

Work MUST not be covered up or enclosed until it has been inspected, tested and approved by the authorities having jurisdiction over this work. Should any of the work be enclosed or covered up before such inspection and test, the Contractor MUST uncover the work at the Contractor's expense; after it has been inspected, tested and approved, the Contractor MUST restore the work to its original condition. The electrical contractor is responsible for notifying the New Hanover County Inspections department to schedule required inspections.

1.11 REFERENCE STANDARDS

A. All electrical equipment, materials, and installation MUST be in accordance with the latest edition of the following codes and standards:

1. American Association of Edison Illuminating Companies (AEIC)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. Building Officials Code Administrators (BOCA)
5. Energy Code 90.1 (ASHRAE/IES)
6. Institute of Electrical and Electronic Engineers (IEEE)
7. Insulated Cable Engineers Association (ICEA)
8. International Code Council (ICC)
9. International Conference of Building Officials (ICBO)
10. National Electrical Code (NEC) 2020 edition
11. National Electrical Contractor's Association (NECA)
12. National Electrical Installation Standards (NEIS)
13. National Electrical Manufacturer's Association (NEMA)
14. National Electrical Safety Code (NESC)
15. National Fire Protection Association (NFPA)
16. North Carolina State Building Code (NCSBC)
17. North Carolina Construction Manual with GS as listed (NCCM)
18. Occupational Safety and Health Act (OSHA)
19. Requirements of the Americans with Disabilities Act (ADA), latest edition.
20. Underwriters Laboratories Inc (UL)
21. Southern Building Code Congress International (SBCCI)
22. Toxicity Characteristics Leaching Procedure (TCLP)
23. North Carolina Energy Conservation Code

B. All electrical equipment and material MUST be listed by Underwriters Laboratories, Inc., and MUST bear the appropriate U.L. listing mark or classification marking. Equipment, materials, etc. utilized not bearing a U.L. certification MUST be field or factory U.L. certified prior to equipment acceptance and use.

C. Where reference is made to one of the above standards, the revision in effect at the time of the bid opening MUST apply.

1.12 ENCLOSURE TYPES

Unless otherwise specified herein or shown on the Drawings, electrical enclosures MUST have the following ratings:

1. NEMA 1 for dry, indoor locations.
2. NEMA 3R for outdoor locations, rooms below grade (including basements and buried vaults), “DAMP” and “WET” locations.
3. NEMA 4X for locations subject to corrosion when specifically noted.

1.13 CORROSION PROTECTION

All equipment and hardware subject to exposure to the elements and/or not installed in a conditioned space MUST be fabricated of non-metallic materials, hot dip galvanized after fabrication or stainless steel. The requirements of preceding section entitled “Delivery and Storage” MUST be strictly followed. Touch up any scratched metallic surfaces immediately to prevent corrosion. Apply cold galvanizing compound to all galvanized surfaces damaged during installation, i.e., cutting, etc. Ferrous, rusted or corroded materials MUST be replaced before final acceptance of the work.

1.14 CODES, INSPECTION AND FEES

A. All equipment, materials and installation MUST be in accordance with the requirements of the local authority having jurisdiction.

B. The Electrical Contractor MUST obtain all necessary permits and pay all fees required for permits and inspections of electrical work.

C. The Electrical Contractor MUST contact Code Officials to schedule any and all required inspections.

1.15 TESTS AND SETTINGS

A. Test all systems furnished under Division 26 and repair or replace all defective work. Make all necessary adjustments to the systems and instruct the Owner’s personnel in the proper operation of the systems.

B. Make the following minimum tests and checks prior to energizing electrical equipment:
   1. Mechanical inspection, testing and settings of all circuit breakers, disconnect switches, motor starters, control equipment, etc., for proper operation.
   2. Check all wire and cable terminations. Verify to the Engineer that connections meet the equipment torque requirements.
   3. Check rotation of motors, obtain permission from other contractors to start motor, and proceed to check for proper rotation. If the motor rotates in the wrong direction, correct it. Take all necessary precautions not to damage any equipment.
   4. Provide all instruments and equipment for the tests specified herein.

C. All testing MUST be scheduled and coordinated by the Contractor. Notify the Owner at least two (2) weeks in advance of conducting tests. The Contractor MUST have qualified personnel present during all testing.

D. All tests MUST be completely documented with the time of day, date, temperature, and all other pertinent test information. All required documentation of readings indicated MUST be submitted to the Engineer prior to, and as one of the prerequisites for, final acceptance of the project.

E. Electrical Distribution System Tests: All current carrying phase conductors and neutrals MUST be tested as installed, and before load connections are made, for insulation resistance and accidental grounds. This MUST be done with a 500 volt megger. The following procedures MUST be as follows:
   1. Minimum readings MUST be one million (1,000,000) ohms or more for #6 AWG wire and smaller; 250,000 ohms or more for #4 AWG wire or larger. Measurement to be taken between conductors and between conductor and the grounded metal raceway.
   2. After all fixtures, devices and equipment are installed and all connections completed to each panel, the Contractor MUST 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 250,000 ohms, the Contractor MUST disconnect the branch circuit neutral wires from this neutral bar. The Contractor MUST then test each one separately to the panel until the low reading ones are found. The Contractor MUST correct troubles, reconnect and retest until at least 250,000 ohms from the neutral bar to the grounded panel can be achieved with only the neutral feeder disconnected.
   3. The Contractor MUST send a letter to the Engineer certifying that the above has been done and tabulating the megger readings for each panel. This MUST be done at least four (4) days prior to final inspection.
   4. At inspection, the Contractor MUST furnish a megger and show Engineer's representative that the panels comply with the above requirements. The Contractor MUST also furnish a clamp type ammeter and a voltmeter and take current and voltage readings as directed by the representatives.
   5. At inspection, the Contractor MUST furnish ladders, required tools, and mechanics to open fixtures, boxes, panels, or any other equipment to enable the Engineer's representatives to see into any parts of the installation that may be requested.

F. Electrical Grounding System Tests: Provide documentation showing values of earth ground impedance for the system ground. See Specifications Section 260526 for testing requirements.

1.16 SLEEVES AND FORMS FOR OPENINGS

A. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work MUST be furnished, located and installed by the Electrical Contractor. The Electrical Contractor MUST 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, then the Electrical Contractor MUST cut and patch construction as necessary and required to install electrical work. Such cutting and patching will be done by the General Contractor but paid for by the Electrical Contractor

B. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.

C. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, request shop drawings, equipment location drawings, foundation drawings, and any other data required to locate the concealed conduit before the floor slab is poured.

D. Where such data is not available in time to avoid delay in scheduled floor slab pours, the Engineer may elect to allow the installations of such conduits to be exposed. No additional compensation for such change will be allowed and written approval must be obtained from the Engineer.

E. Seal all openings, sleeves, penetration, and slots as specified and as shown on the Contract Drawings.

1.17 CUTTING AND PATCHING

A. Anchor bolts, sleeves, inserts, supports, etc., that may be required for electrical work MUST be furnished, located and installed by the Electrical Contractor. The Electrical Contractor MUST 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, then the Electrical Contractor MUST cut and patch construction as necessary and required to install electrical work. Such cutting and patching will be done by the General Contractor but paid for by the Electrical Contractor.

B. The Electrical Contractor MUST perform all cutting and patching necessary to install all equipment as required under his contract and MUST re-establish all finishes to their original condition where cutting and patching occur.

C. All cutting and patching MUST be done in a thoroughly workmanlike manner.

D. Core drill holes in existing concrete floors and walls as required.

E. Install work at such time as to require the minimum amount of cutting and patching.

F. Do not cut joists, beams, girders, columns or any other structural members without first obtaining written permission from the Engineer.

G. Cut opening only large enough to allow easy installation of the conduit.

H. Patching is to be of the same kind of material as was removed.

I. The completed patching work MUST restore the surface to its original appearance.

J. Patching of waterproofed surfaces MUST render the area of the patching completely waterproofed.

K. Remove rubble and excess patching materials from the premises.

L. Raceways and ducts penetrating rated floor, ceiling or wall assemblies MUST be properly sealed in accordance with the corresponding Underwriters Laboratories approved method utilizing approved and listed materials.

1.18 INTERPRETATION OF DRAWINGS

A. The Electrical drawings and specifications are complementary each to the other and what may be called for by one MUST be as binding as if called for by both. The drawings are diagrammatic and indicate generally the location of outlets, devices, equipment, wiring, etc. Drawings MUST be followed as closely as possible; however, all work MUST suit the finished surroundings and/or trim.

B. Do not scale electrical drawings. Refer to the architectural drawings for dimensions.

C. Where the words “furnish and install” or “provide” are used, it is intended that this contractor MUST purchase and install completely any and/or all material necessary and required for this particular item, system, equipment, etc.

D. Where the words “the Contractor” or “this Contractor” appear in either the Electrical Drawings or Division 26 Specifications, it MUST mean the Electrical Contractor.

E. Any omission from either the drawings or these specifications are unintentional, and it MUST be the responsibility of this Contractor to call to the attention of the Engineer any pertinent omissions before submitting a bid. Complete and working systems are required, whether every small item of material is shown and specified or not.

F. Where no specific material or equipment type is mentioned, a high quality product of a reputable manufacturer may be used provided it conforms to the requirements of these specifications. These

materials MUST be listed or labeled by a Third Party Testing Agency accredited by the NCBCC to label electrical equipment.

G. The electrical drawings show the general arrangement of raceways, equipment, fixtures, and appurtenances and MUST be followed as closely as actual building construction and the work of other trades will permit. Some adjustment of routings and installation of conduit, cable tray and devices should be expected. The electrical work MUST conform to the requirements shown on all of the drawings. General and Structural drawings MUST take precedence over Electrical Drawings. Because of small scale of the electrical drawings, it is not possible to indicate offsets, fittings and accessories which may be required. The Contractor MUST investigate the structural and finish conditions affecting the work and MUST 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 Engineer.

H. Each 3-phase circuit MUST be run in a separate conduit unless otherwise shown on the Drawings.

I. Unless otherwise approved by the Engineer, conduit shown exposed MUST be installed exposed; conduit shown concealed MUST be installed concealed.

J. Where circuits are shown as “home runs” all necessary fittings and boxes MUST be provided for a complete raceway installation.

K. Any work installed contrary to or without approval by the Engineer MUST be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

L. The locations of equipment, fixtures, outlets, and similar devices shown on the Drawings are approximate only. Exact locations MUST be as approved by the Engineer during construction. Obtain in the field all information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

M. Surface mounted panel boxes, junction boxes, conduit, etc., MUST be supported by spacers to provide a clearance between wall and equipment.

N. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits MUST be installed wherever needed to conform to the specific requirements of equipment.

O. All connections to the equipment MUST be made as required, and in accordance with the approved shop and setting drawings.

P. Redesign of electrical work, which is required due to the Contractor’s use of an alternate item, arrangement of equipment and/or layout other than specified herein, MUST be done by the Contractor at the Contractor’s expense. Redesign and detailed plans MUST be submitted to the Engineer for approval. No additional compensation will be provided for changes in the work, either the Electrical Contractor’s or others, caused by such redesign.

Q. All floor mounted electrical equipment MUST be placed on 4-inch thick concrete housekeeping pads. Edges MUST be chamfered.

1.19 SIZE OF EQUIPMENT

A. Investigate each space in the structure through which equipment must pass to reach its final location. If necessary, the manufacturer MUST be required to ship his materials in sections sized to permit passing through such restricted areas in the structure.

B. The equipment MUST be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the manufacturer MUST be required to suitably brace the equipment, to insure that the tilting does not impair the functional integrity of the equipment.

1.20 RECORD DRAWINGS

A. As the work progresses, legibly record all field changes on one set of project contract drawings, herein after called the “record drawings”.

B. Record drawings MUST accurately show the installed condition of the following items:
   1. Power distribution one-line diagram(s).
   2. Panel schedule(s)
   3. Control wiring diagram(s).

1.21 GUARANTEE

The Contractor MUST guarantee the materials and workmanship covered by these drawings and specifications for a period of one year from the date of acceptance by the Owner. The Contractor MUST repair and/or replace any parts of any system that may prove to be defective at no additional cost to the Owner within the guarantee period. All equipment warranties MUST be as specified and included in the Contract Documents.

1.22 PHASING OF THE WORK

The Electrical Contractor MUST schedule his work as described in the relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

PART 2 PRODUCTS Not used

PART 3 EXECUTION Not used

END OF SECTION

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building wire and cable.

B. Wiring connectors and connections.

1.02 RELATED SECTIONS

A. Section 260533 - Conduit.

B. Section 260534 - Boxes.

C. Section 260553 - Identification.

1.03 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code.

B. NECA Standard of Installation (National Electrical Contractors Association).

1.04 SUBMITTALS

A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide manufacturer's catalog information showing dimensions, ratings, colors, and configurations.

C. Test Reports: Indicate procedures and values obtained.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.07 PROJECT CONDITIONS

A. All wire and cable MUST be installed in conduit. This includes all power wiring; fire alarm, sound and communications wire and cable (unless noted otherwise); HVAC control cable; etc.

B. Verify that field measurements are as shown on Drawings.

C. Conductor sizes are based on 75° C. copper.

D. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

E. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.08 COORDINATION

A. Coordinate Work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

PART 2 PRODUCTS

2.01 BUILDING WIRE AND CABLE

A. Description: Single conductor insulated building wire.

B. Conductor: Copper. Solid and stranded as specified below. Minimum #12 AWG, maximum 500 KCMil.

C. Insulation/Voltage Rating: 600 volts.:

D. Insulation: Dual-rated THHN/THWN or XHHW.

E. Color Coding:

	120/240 volts and 208/120 volts	480/277 volts
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

2.02 WIRING CONNECTORS AND CONNECTIONS

A. Conductors MUST be installed continuous from outlet to outlet with no splicing except within outlet or junction boxes, troughs and gutters. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

B. Use mechanical connectors for copper conductor splices and taps, 8 AWG and larger, except main grounding conductors, which MUST be terminated with compression lugs. Tape un-insulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor or use third party testing agency-approved insulating covers.

C. Use insulated spring wire connectors with plastic caps for copper conductors, 10 AWG and smaller, splices and taps in junction boxes, outlet boxes and lighting fixtures, Ideal “wirenuts”, 3M Company “Scotchlock” or connectors in. “Push wire” type connectors are not acceptable.

D. “Sta-Kon” or other permanent type crimp connectors MUST not be used for branch circuit connections.

E. Joints in stranded conductors MUST be spliced by approved mechanical connectors and gum rubber tape or friction tape. Solderless mechanical connectors for splices and taps, provided with U.L approved insulating covers, may be used instead of mechanical connectors plus tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that mechanical work likely to damage wire has been completed.:

C. Verify that raceway installation is complete and supported.

3.02 PREPARATION

A. Completely and thoroughly swab raceway before installing wire.

3.03 WIRING METHODS

A. Concealed Dry Interior Locations: Use only building wire in raceway

B. Exposed Dry Interior Locations: Use only building wire in raceway.

C. Above Accessible Ceilings: Use only building wire in raceway.

D. Wet or Damp Interior Locations: Use only building wire in raceway.

E. Exterior Locations: Use only building wire in raceway.

3.04 INSTALLATION

A. Install products in accordance with manufacturers instructions.

B. Route wire and cable as required to meet Project Conditions.

C. Install cable in accordance with the NECA “Standard of Installation”.

D. Use solid conductor for feeders and branch circuits 10 AWG and smaller, and Class B stranded for larger conductors.

E. Use conductor not smaller than 12 AWG for power and lighting circuits.

F. Use conductor not smaller than 14 AWG for fire alarm and control circuits.

G. Use 10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 75 feet (23 m) or branch circuit homeruns longer than 50 feet.

H. Use 10 AWG conductors for 20 ampere, 277 volt branch circuits longer than 200 feet or branch circuit homeruns longer than 125 feet.

I. Pull all conductors into raceway at same time.

J. Use suitable wire pulling lubricant for building wire 4 AWG and larger.

K. Neatly train and lace wiring inside boxes, equipment, and panelboards.

L. Clean conductor surfaces before installing lugs and connectors.

M. Identify wire and cable under provisions of Section 260553.

N. Identify each conductor with its circuit number or other designation indicated on Drawings.

O. Common neutral multiwire receptacle branch circuits are not permitted. Provide separate, individual neutral conductors for receptacle circuits.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Inspect wire for physical damage and proper connection.

C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

D. Verify continuity of each branch circuit conductor.

E. Prior to energizing, feeders, sub-feeders and service conductor cables MUST be tested for electrical continuity and short circuits. A copy of these tests MUST be sent to the North Carolina State Construction Office through the Architect.

END OF SECTION

SECTION 260526
GROUNDING AND BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES:

A. Grounding electrodes and conductors.

B. Equipment grounding conductors.

C. Grounding well components.

1.02 RELATED SECTIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260519 – Building Wire and Cable.

C. Section 260533 - Conduit.

D. Section 260534 - Boxes.

E. Section 260553 – Electrical Identification.

1.03 REFERENCES

A. IEEE 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

B. NFPA 70 - National Electrical Code.

1.04 GROUNDING SYSTEM DESCRIPTION

A. The neutral of each secondary electrical distribution system shall be grounded at one point only which shall be at the main disconnecting device. From the main disconnecting device, a copper grounding conductor sized in accordance with the NEC shall be extended to the earth electrode. Main grounding conductors #8 AWG through and including #4 AWG shall be insulated and identified by a green colored insulation. All grounding conductors shall be installed in conduit sized in accordance with the NEC. Conduit carrying a grounding conductor shall also be grounded at the earth electrode.

1.05 PERFORMANCE REQUIREMENTS

A. The ground resistance of the earth electrode shall not exceed 5 ohms. The Electrical Contractor shall test the earth electrode using a standard three point ground resistance tester and shall advise the Architect/Engineer of the results of such tests in writing. Where tests show the resistance to ground exceeds 5 ohms, appropriate action shall be taken to reduce the resistance to 5 ohms, or less, by driving additional ground rods or other approved methods. Compliance shall be demonstrated by retesting.

1.06 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide for grounding electrodes and connections.

1.07 SUBMITTALS FOR INFORMATION

A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections

B. Test Reports: Indicates overall resistance to ground and resistance of each electrode.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.08 SUBMITTALS FOR CLOSEOUT

A. Contract Closeout: Procedures for submittals as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Project Record Documents: Record actual locations of components and grounding electrodes.

C. Certificate of Compliance: Indicate approval of installation by authority having jurisdiction.

1.09 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.

1.10 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 MECHANICAL CONNECTORS

A. Material: Cast bronze, brass, or plain malleable iron. Ground clamps shall not be fabricated from aluminum or any aluminum alloy.

2.02 WIRE

A. Material: Copper. Use solid conductor for 10 AWG and smaller, and Class B stranded for larger conductors, all sized per NEC requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Coordination and Meetings: Verify existing conditions prior to beginning work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

3.02 INSTALLATION

A. Quality Control: Manufacturer's instructions shall be followed as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Provide bonding to meet Regulatory Requirements.

C. Provide separate, insulated conductor within each feeder and branch circuit raceway.

D. Equipment Grounding Conductor: The raceway system shall not be relied on for ground continuity. A green grounding conductor, properly sized per the NEC shall be run in all raceways. Terminate each end on suitable lug, bus, or bushing. Exceptions are as follows:
   1. Raceways for telecommunications.
   2. Raceways for data.
   3. Raceways for audio conductors.

E. Equipment grounding continuity shall be maintained through flexible conduit as required in previous sections.

F. Grounding conductors shall be installed as to permit the shortest and most direct path from equipment to ground. All connections to ground conductors shall be accessible for inspection and made with approved solderless connectors, brazed or bolted to the equipment or structure to be grounded. All contact surfaces shall be thoroughly cleaned before connections are made to insure good metal to metal contact.

G. All equipment housings and/or enclosures, and all non-current carrying metallic parts of electrical equipment, raceway systems, etc., shall be effectively and adequately bonded to ground.

H. Grounding type insulated bonding bushings and jumpers shall be provided where concentric, eccentric or over-sized knockouts are encountered. The jumpers shall be sized per NEC Table 250-66 for services and transformers, and per Table 250-122 for branch circuits.

I. All metallic raceways entering or leaving panelboards (branch circuits less than 30 amperes in lighting and appliance branch circuit panelboards excepted), switchboards, transfer switches, enclosed circuit breakers, safety switches, transformers, pull boxes, splice boxes, etc. shall be provided with insulated grounding and bonding bushings and each separate piece of raceway shall be individually bonded to the equipment ground bus or metallic enclosure, as applicable, by means of copper conductor sized in accordance with the National Electrical Code, Tables 250-66 for services and transformers and 250-122 for other circuits.

J. An equipment ground bus shall be installed in each panelboard for terminating equipment grounding conductors

K. All wiring devices equipped with grounding connections shall be permanently and securely connected to the enclosure in which they are mounted with a copper grounding jumper.

L. The frame of all lighting fixtures shall be securely grounded to the equipment ground system with grounding conductors.

3.03 EXISTING WORK

A. If the work includes renovation and/or addition to existing conditions:

   1. Modify existing grounding system to maintain continuity and to accommodate renovations.

   2. Extend existing grounding system using materials and methods specified.

3.04 FIELD QUALITY CONTROL

A. Quality Assurance: Field inspection, testing and adjusting as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

END OF SECTION

SECTION 260529
SUPPORTING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit and equipment supports.

B. Anchors and fasteners.

1.02 REFERENCES

A. NECA - National Electrical Contractors Association.

B. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide manufacturer's catalog data for fastening systems.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.04 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 PRODUCT REQUIREMENTS

A. Materials and Finishes: Provide adequate corrosion resistance.

B. Provide materials, sizes, and types of anchors, fasteners and supports to carry the loads of equipment and conduit. Consider weight of wire in conduit when selecting products.

C. Anchors and Fasteners:
   1. Concrete Structural Elements: Use expansion anchors.
   2. Steel Structural Elements: Use beam clamps.
   3. Concrete Surfaces: Use self drilling anchors and expansion anchors.
   4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.
   5. Solid Masonry Walls: Use expansion anchors.
   6. Sheet Metal: Use sheet metal screws or bolts
   7. Wood Elements: Use wood screws.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide anchors, fasteners, and supports in accordance with NECA "Standard of Installation".

C. Do not fasten supports to pipes, ducts, mechanical equipment, and conduit.

D. Do not use powder-actuated anchors.

E. Obtain permission from Architect/Engineer before drilling or cutting structural members.

F. Fabricate supports from structural steel or steel channel. Rigidly weld members or use hexagon head bolts to present neat appearance with adequate strength and rigidity. Use spring lock washers under all nuts.

G. Install surface-mounted cabinets and panelboards with minimum of four anchors.

H. In wet and damp locations use steel channel supports to stand cabinets and panelboards one inch (25 mm) off wall.

I. Conduits installed on the interior of exterior building walls shall be spaced away from the wall surface a minimum of 1/4 inch (65mm) using "clamp-backs" or struts.

J. Use sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.

END OF SECTION

SECTION 260533

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal conduit.

B. Flexible metal conduit.

C. Liquidtight flexible metal conduit.

D. Electrical metallic tubing.

E. Nonmetallic conduit.

F. Surface Raceway

1.02 RELATED SECTIONS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 7: Fire Stopping.

C. Division 7: Roofing penetrations.

D. Section 260534 - Boxes.

E. Section 260526 - Grounding and Bonding.

F. Section 260529 - Supporting Devices.

G. Section 260553 - Electrical Identification.

1.03 REFERENCES

A. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.

B. ANSI C80.3 - Electrical Metallic Tubing, Zinc Coated.

C. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

D. ANSI/NFPA 70 - National Electrical Code.

E. NECA “Standard of Installation”.

F. NEMA TC2 - Schedule 40 PVC.

G. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.04 DESIGN REQUIREMENTS

Conduit Size: ANSI/NFPA 70.

1.05 SUBMITTALS

A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide for metallic conduit, flexible metal conduit, liquidtight flexible metal conduit, metallic tubing, nonmetallic conduit, fittings and conduit bodies.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Accurately record actual routing of conduits larger than 2 inches (51 mm).

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

1.09 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of conduit prior to rough-in.

C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 PRODUCTS

2.01 CONDUIT REQUIREMENTS

A. Size: Conduit shall be sized in accordance with the latest edition of the NEC unless shown otherwise, with minimum conduit size of ½ inch, except homeruns minimum size shall be 3/4". Flexible metal and watertight ("sealtite") conduit in size ½ inch and larger are acceptable for motor, appliance and fixture connections provided green ground wire is installed (see Section 260526) and NEC is followed.

B. All conduit will be provided with insulated throat.

C. Underground Installations:

1. More than Five Feet from Foundation Wall: Use rigid steel conduit, intermediate metal conduit, plastic coated conduit, thickwall nonmetallic conduit and thinwall nonmetallic conduit.
2. Within Five Feet from Foundation Wall: Use rigid steel conduit.
3. In or Under Slab on Grade: Use rigid steel conduit, intermediate metal conduit, plastic coated conduit, thickwall nonmetallic conduit and thinwall nonmetallic conduit.
4. Minimum Size: 1 inch (25 mm).

D. Outdoor Locations, Above Grade: Use rigid steel conduit.

E. In Slab Above Grade:
1. Use rigid steel conduit.
2. Maximum Size Conduit in Slab: 3/4 inch (19 mm).

F. Wet and Damp Locations: Use rigid steel conduit.

G. Dry Locations:
1. Concealed: Use rigid steel conduit, intermediate metal conduit or electrical metallic tubing. EMT may be utilized as permitted by the NEC, with the following restrictions. EMT shall not be installed:
Standard Language:
a. where tubing, couplings, elbows and fittings would be in direct contact with the earth.
b. underground (in/below slab-on-grade or in earth).
c. any location outdoors where the tubing, etc., would be subjected to the elements.
d. where subject to severe corrosive influence.
e. where subject to severe physical damage.

2.02 METAL CONDUIT

A. Rigid Steel Conduit: ANSI C80.1.

B. Plastic-Coated Rigid Steel Conduit: ANSI C80.1, 40 mil PVC coating.

C. Intermediate Metal Conduit (IMC): Rigid steel.

D. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit with zinc-plated steel or malleable iron fittings.

2.03 FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction

B. Fittings: ANSI/NEMA FB 1, steel.

2.04 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Description: Interlocked steel construction with PVC jacket.

B. Fittings: ANSI/NEMA FB 1, steel or nonmetallic type.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Description: ANSI C80.3; galvanized tubing.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel or malleable iron, compression type, insulated throat.

2.06 NONMETALLIC CONDUIT

A. Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.07 ONE PIECE SURFACE METAL RACEWAY

A. The raceway shall be dual channel (one side for power and one side for data) with a base and cover factory assembled.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5.

C. A hand operated cutting tool shall be available for the base and cover to ensure clean, square cuts.

D. A full complement of fittings shall be available including but not limited to mounting clips and straps, couplings, flat, internal and external elbows, cover clips, tees, entrance fittings, conduit connectors and bushings. The covers shall be painted with an enamel finish, in to match the raceway. They shall overlap the raceway to hide uneven cuts. All fittings shall be supplied with a base where applicable.

E. Device boxes shall be available for mounting standard devices and faceplates. A device box shall be available in single- and multiple-gang configurations up to six-gang. They shall range in depth from 0.94" to 2.75" [23.88mm to 69.85mm]. Single-gang boxes shall allow for snap-on and fastener application. Extension boxes shall be available to adapt to existing standard flush switch and receptacle boxes. All device and fixture box covers shall be painted with an enamel finish, ivory in color to match the raceway cover.

F. The raceway manufacturer will provide a complete line of connectivity outlets and modular inserts for UTP/STP Fiber Optic, Coaxial and other cabling types with face plates and bezels to facilitate mounting. A complete line of preprinted station and port identification labels, snap-in icon buttons as well as write-on station identification labels shall be available.

G. Raceway shall be paintable to match adjacent colors.

H. Raceway shall be painted by Electrical Contractor.

PART 3 EXECUTION

3.01 INSTALLATION

A. Circuiting is shown schematically. Exact routing of branch circuits may be varied to suit building construction; however, the combination of circuits within raceways and panelboard connections shall not be changed from those shown on the drawings.

B. Raceways shall be installed concealed in finished areas. Where construction does not permit concealed raceways and where indicated on the drawings, raceways shall be run exposed. Exposed raceways shall be run parallel to, or at a right angle with the building walls. Route conduit installed above accessible ceilings parallel and perpendicular to walls.

C. Where any run of rigid conduit may change to a run of EMT or vice-versa, each change shall be made in a junction or outlet box with each conduit terminated separately therein. Rigid conduit to EMT (or vice-versa) adapters shall not be permitted.

D. Install conduit in accordance with NECA “Standard of Installation”.

E. Arrange conduit to maintain headroom and present neat appearance.

F. Maintain adequate clearance between conduit and piping.

G. Maintain 12 inch (300 mm) clearance between conduit and surfaces with temperatures exceeding 104 degrees F (40 degrees C).

H. Cut conduit square using saw or pipecutter and de-burr cut ends.

I. Bring conduit to shoulder of fittings; fasten securely.

J. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

K. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows, or hydraulic one-shot bender, to fabricate bends in metal conduit larger than 2 inch size.

L. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

M. Provide suitable fittings to accommodate expansion and deflection where conduit crosses control and expansion joints.

N. Provide suitable pull string in each empty conduit except sleeves and nipples.

O. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

P. The raceway system shall not be relied on for grounding continuity. Ground and bond conduit under provisions of Section 260526.

Q. Identify conduit under provisions of Section 260553.

R. The use of “LB’s” shall be limited where possible. Where necessary to use “LB’s” sized above 2 inch, mogul units shall be installed.

S. Where concentric, eccentric or over-sized knockouts are encountered, a grounding type insulated bushing shall be provided.

T. Fasten conduit supports to building structure and surfaces under provisions of Section 260529.

U. Arrange supports to prevent misalignment during wiring installation.

V. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.

W. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

X. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

Y. Do not attach conduit to ceiling support wires.

Z. All metallic raceways entering or leaving panelboards (branch circuits less than 30 amperes in lighting and appliance branch circuit panelboards excepted), switchboards, transfer switches, enclosed circuit breakers, safety switches, transformers, pull boxes, splice boxes, etc. shall be provided with insulated grounding and bonding bushings and each separate piece of raceway shall be individually bonded to the equipment ground bus or metallic enclosure, as applicable, by means of copper conductor sized in accordance with the National Electrical Code.

AA. The term “fittings” includes couplings, connectors, offsets, LBs, etc.

BB. No pressure cast (pot metal) fittings or conduit bodies shall be allowed.

CC. Outlets, junction, taps, etc., on exposed rigid metal conduit shall be cast malleable iron conduit fittings or cast malleable metal boxes of the type and size appropriate for the location. Sheet steel outlet boxes shall not be permitted on exposed raceway runs except at or near a ceiling for interior construction.

DD. EMT couplings and terminations shall be made utilizing zinc-plated, steel hexagonal compression connectors. No set screw or indented type fittings shall be utilized.

EE. EMT couplings and terminations shall be “concrete tight” where buried in masonry or concrete. EMT fittings, where installed in damp locations, shall be of the “raintight” type.

FF. Install nonmetallic conduit in accordance with manufacturer’s instructions.

GG. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

HH. PVC schedule 40 shall not be used exposed or concealed in gypsum walls, but may be used in CMU walls.

II. IMC and GRC shall terminate with either a double locknut / bushing set, or in a threaded hub.

JJ. Conduit couplings for IMC, GRC and PVC shall be in accordance with the NEC.

KK. The placement of conduit in floor slabs shall be thoroughly coordinated with the General Contractor to avoid conflicts with steel reinforcing bars, reductions in net concrete sections and floor penetrations.

LL. Route conduit in and under slab from point-to-point.

MM. Where underground or underslab service and feeder raceways are required to turn up into cabinets, equipment, etc., and on to poles, the elbow required and the stub-up out of the slab or earth shall be of 40 mil plastic-coated rigid steel. Alternately, field applied corrosion protection wrap systems utilizing a primer, putty tape and all-weather corrosion protection tape may be used, in equivalent thickness to factory applied materials, with the specific approval of the Architect/Engineer.

NN. Raceways run external to building foundation walls, with the exception of branch circuit raceways, shall be encased with a minimum of three (3) inches of concrete on all sides.

OO. Raceways that penetrate outside walls, ceilings from conditioned space or other similar condition shall be effectively sealed to prevent condensation from infiltrating humid air.

PP. Where raceways pass through a below grade wall, from a conditioned interior building space, the raceway shall be sealed utilizing fittings similar and equal to OZ/GEDNEY type “FSK” thru-wall fitting with “FSKA” membrane clamp adapter if required.

QQ. All underground raceways shall be identified by underground line marking tape within the provisions of Section 260553. The tape to be located directly above the raceway and 6 to 8 inches below finished grade.

RR. EMT conduit provided below roof deck shall be installed 11/2 inches away from the deck to allow for screws not to penetrate the EMT conduit during reroofing.

SS. Conduits, JBs, Troughs, any enclosure when mounted outside on the walls, shall be off the walls by one inch.

TT. Surface metal raceways shall be used only where indicated on the drawings. All hardware and supports shall be per NEC and supplied by with raceway.

UU. Surface Raceways:
1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

B. Route conduit through roof openings for piping and ductwork or through suitable roof jack with pitch pocket. Coordinate location with roofing installation specified under Division 7.

END OF SECTION

SECTION 260534
BOXES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

1.02 RELATED SECTIONS

A. Division 7: Firestopping.

B. Division 8: Access Doors.

C. Section 262726 - Wiring Devices: Wall plates in finished areas and floor box service fittings

D. Section 260529 – Supporting Devices.

1.03 REFERENCES

A. NECA - Standard of Installation.

B. NEMA FB 1 - Fittings and Supports for Conduit and Cable Assemblies.

C. NEMA OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide manufacturer's catalog information showing dimensions and configurations.

1.05 SUBMITTALS FOR CLOSEOUT

A. Contract Closeout: Submittals for Project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Junction, switch, receptacle and outlet boxes for interior use in dry locations shall be zinc coated or cadmium plated sheet steel, 4” square and 2-1/8” deep, unless otherwise indicated on the contract drawings. Smaller and shallower outlet boxes will be permitted only by special permission of the Architect/Engineer where such boxes are necessary due to structural conditions encountered. Where larger junction boxes are required, they shall be fabricated from No. 10, 12, 14 or 16 gauge sheet steel as required by the Underwriters Laboratories, Inc., and galvanized after fabrication. All junction boxes shall have screw fastened covers. Outlet boxes shall be provided with extension plaster rings where required by structural and finish conditions. Sheet steel boxes shall be as manufactured by Appleton, Raco, Steel City or Spring City.
2. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 2 inch (13 mm) male fixture studs where required.
3. Concrete Ceiling Boxes: Concrete type.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs. Cast boxes shall be by Crouse-Hinds, Appleton, O. Z. Gedney or Killark.

C. Wall Plates for Finished Areas: As specified in Section 262726.

2.02 PULL AND JUNCTION BOXES

Sheet Metal Boxes: NEMA OS 1, galvanized steel

PART 3 - EXECUTION

3.01 EXAMINATION

Verify locations of floor boxes and outlets prior to rough-in.

3.02 INSTALLATION

A. Install boxes in accordance with NECA “Standard of Installation”.

B. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.

C. Set wall mounted boxes at elevations to accommodate mounting heights indicated and specified in section for outlet device. Boxes are shown on Drawings in approximate locations unless dimensioned. Adjust box location up to 10 feet (3 m) if required to accommodate intended purpose. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes. Use flush mounting outlet box in finished areas. Use stamped steel bridges to fasten flush mounting outlet box between studs.

3.03 ADJUSTING

A. Contract Closeout: Adjust installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.04 CLEANING

A. Contract Closeout: Clean installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Clean interior of boxes to remove dust, debris, and other material.

C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 260553
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates and labels.

B. Wire and cable markers.

C. Conduit markers.

D. Wiring device plates marking.

1.02 RELATED SECTIONS

Division 9: Painting.

1.03 REFERENCES

ANSI/NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide catalog data for nameplates, labels, and markers.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of Product.

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 NAMEPLATES AND LABELS

A. Nameplates: Engraved three-layer laminated plastic as follows:

Furnish and install engraved laminated phenolic nameplates for all electrical equipment supplied under this contract for identification of system, equipment controlled or served, phase, voltage, ampacity, fault current, etc. Nameplates shall be securely attached to equipment with stainless steel screws, and shall identify by name the equipment controlled, attached, etc. Embossed, self adhesive plastic tape is not acceptable for marking equipment. Nameplate material colors shall be:

1. Blue surface with white core for all 120/208 volt equipment.

2. Black surface with white core for 277/480 volt equipment.
3. Bright red surface with white core for all equipment related to fire alarm system.
4. Dark red (burgundy) surface with white core for all equipment related to Security.
5. Green surface with white core for all equipment related to “emergency” systems.
6. Orange surface with white core for all equipment related to telephone systems.
7. Brown surface with white core for all equipment related to data systems.
8. White surface with black core for all equipment related to paging systems.
9. Purple surface with white core for all equipment related to TV systems.

B. Locations:
1. Each electrical distribution and control equipment enclosure (safety switches, panelboards, transformers, etc.)
2. Communication cabinets.
3. Pull and splice boxes.

C. Letter Size: Letters shall be a minimum of 1/2 inch (13 mm) high.

D. See details on the Drawings for additional requirements.

2.02 WIRE MARKERS

A. Description: Split sleeve type wire markers or approved equivalent.

B. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, and each load connection.

C. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number as indicated on drawings.
2. Control Circuits: Control wire number as indicated on schematic and interconnection diagrams on drawings.

D. Multiwire branch circuit phase conductors shall be clearly identified in each branch circuit panelboard. Attach a yellow flag type plastic cable tie to each phase conductor of a multiwire branch circuit at approximately 2” from the circuit breaker terminal. Install a yellow with black letter identification label in the panelboard door stating “Yellow cable tie flags on conductors indicate the conductor is part of a common neutral multiwire branch circuit. DO NOT MOVE CONDUCTOR TO ANOTHER BREAKER”.

2.03 CONDUIT, RACEWAY AND BOX MARKING

Paint visible surfaces of exposed junction and outlet boxes and covers of raceway systems above lay-in and other accessible ceilings. Paint all boxes and covers before installation. Paint exposed conduit and raceways at ten foot minimum intervals with a 6 inch wide band in accordance with the color scheme outlined above. Mark conduits at junction boxes above accessible ceilings with the panelboard and circuit numbers of the circuits contained in the raceway using a permanent black marking pen.

2.04 WIRING DEVICE PLATES MARKING

A. Description:
1. Adhesive backed, laminated plastic receptacle device plate labels identifying the circuit feeding the device. Labels shall be label machine printed, **black lettering on a clear background**, to indicate panel and circuit number and shall be Casio, Brother, T&B or approved equal.
2. Print circuit number on flag type plastic cable tie with a permanent marker (Sharpie, etc.) and attach to conductors in outlet box. Flag shall be readily visible upon removal of device plate.

B. Locations: Each receptacle device plate. Apply centered on the lower portion below the receptacle, parallel to the lower surface.

C. Legend: Typed labels to indicate panel and circuit number feeding the device (i.e., RPA-24).

PART 3 EXECUTION

3.01 PREPARATION

Degrease and clean surfaces to receive nameplates and labels.

3.02 APPLICATION

A. Install nameplate parallel to equipment lines.

B. Secure nameplate to equipment front using rivets or stainless steel machine screws, lockwashers and acorn nuts as shown on the Drawings. Stainless steel screws and nylon locknuts may be used in lieu of lockwashers and acorn nuts if the screw threads are not exposed.

C. Secure nameplate to inside surface of door on panelboard that is recessed in finished locations.

D. Install receptacle circuit identification labels.

E. Identify conduit using field painting under provisions of Division 9.

F. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate. Identification shall be by tags with string or wire attached to conduit or outlet.

G. Update all existing panelboard directories where changes are made. Provide new panel schedule cards as required to maintain legibility.

H. Install adhesive backed labels only when ambient temperature and humidity conditions for adhesive use are within range recommended by manufacturer.

END OF SECTION

SECTION 260923
ENCLOSED CONTACTORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General purpose contactors.

B. Lighting contactors.

C. Time switches.

D. Photocells.

1.02 RELATED SECTIONS

A. Section 260533 – Raceway and Boxes for Electrical Systems.

B. Section 260526 – Grounding and Bonding.

C. Section 260529 – Supporting Devices.

D. Section 260548.16 – Seismic Controls for Electrical Systems.

E. Section 260533 – Conduit

F. Section 260553 – Electrical Identification

1.03 REFERENCES

A. NEMA ICS 6 Enclosures for Industrial Controls and Systems.

B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies

C. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Submit manufacturer's installation instructions.

1.05 PROJECT CLOSEOUT SUBMITTALS

A. Contract Closeout: Submittals for project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Record actual locations of each contactor and indicate circuits controlled on project record documents.

C. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

1.06 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 LIGHTING CONTACTORS

A. Manufacturers:
   1. Eaton
   2. ABB/General Electric.
   3. Siemens.
   4. Schneider/Square D.
   5. Substitutions: As permitted in relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Description: NEMA ICS 2, magnetic lighting contactor.

C. Configuration: Mechanically held, 3 wire control.

D. Coil Voltage: As indicated/required.

E. Poles: As indicated, with 2 spares minimum.

F. Contact Rating: As indicated, 30 amperes minimum.

G. Enclosure: ANSI/NEMA ICS 6, as indicated.

H. Accessories:
   1. Pushbutton: ON/OFF.
   2. Selector Switch: ON/OFF/AUTOMATIC.
   3. Indicating Light: RED.
   4. Auxiliary Contacts: Two, field convertible.
   5. Astronomical time switch with momentary contact output.
   6. Photocell.

2.02 ACCESSORIES

A. Pushbuttons and Selector Switches: NEMA ICS 2, heavy duty type.

B. Indicating Lights: NEMA ICS 2, transformer type.

C. Auxiliary Contacts: NEMA ICS 2, Class A300.

D. Time Switch: Astronomic, two channel, electronic type with 48 hour capacitor or battery reserve, digital display, 30 ampere output contact rating, two, single pole output contacts, voltage compatible with load served, NEMA-1 enclosure.

E. Photocell: Weatherproof, enclosed, single pole, 1800 VA, 120VAC, twist lock plug-in type with base.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Connect time switch(es) and/or photocell(s) to contactor(s) and program per Owner's requirements to control loads.

B. Install photocell where shown or as required and adjust to provide proper operation.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Lighting and appliance branch-circuit panelboards.

1.02 RELATED SECTIONS

A. Section 260526 - Grounding and Bonding.

B. Section 260553 - Electrical Identification.

C. Section 262813 - Fuses.

1.03 REFERENCES

A. NECA Standard of Installation (published by the National Electrical Contractors Association).

B. NEMA AB1 - Molded Case Circuit Breakers.

C. NEMA ICS 2 - Industrial Control Devices, Controllers and Assemblies.

D. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

E. NEMA PB 1 – Panelboards

F. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment (published by the International Electrical Testing Association).

H. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide manufacturer's catalog information showing dimensions, ratings, features, colors, and configurations.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

1.05 SUBMITTALS FOR INFORMATION

A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

C. The panelboard manufacturer shall provide a facility short circuit and coordination study for approval by the Architect/Engineer. The study shall be performed by a North Carolina Registered Professional Engineer and shall include the utility company transformer and downstream devices including all branch circuit panelboards. All panelboards, enclosed circuit breakers, and safety switch ratings shall conform to the results of this study. This study shall include Panelboard 4MDP-2 and downstream downstream devices and existing Switchboard 4MDP and downstream new devices.

1.06 SUBMITTAL FOR CLOSEOUT

A. Contract Closeout: Submittals for project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Record actual locations of panelboards and record actual circuiting arrangements in project record documents.

C. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.07 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.08 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70

B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.09 MAINTENANCE MATERIALS

A. Contract Closeout. As required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Furnish two of each panelboard key.

PART 2 PRODUCTS

2.01 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers:
   1. Cutler Hammer.
   2. General Electric.
   3. Siemens.
   4. Square D.
   5. Substitutions: As permitted in relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

C. Service Conditions:
   1. Temperature: 104º F. (40º C.).
   2. Altitude: N/A.
   3. Terminal Rating: 75º C. minimum.

D. Panelboard Bus: Copper, ratings as indicated. Provide 100% copper ground and neutrals buses in each panelboard. Provide 200% copper neutral bus where indicated. Provide insulated ground bus where scheduled.

E. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical for 208 volt panelboards, or as indicated.

F. Circuit Breakers: NEMA AB 1, bolt-on type.
   1. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
   2. Current Limiting Molded Case Circuit Breakers: Circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

G. Enclosure: NEMA PB 1, Type 1 or Type 3R.

H. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards.

I. Cabinet Front: Flush and Surface cabinet front door-in-door type (hinged trims are not acceptable) with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

J. Series rated breakers not allowed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards in accordance with NEMA PB 1.1 and the NECA "Standard of Installation."

B. Install panelboards plumb. Install recessed panelboards flush with wall finishes.

C. Panelboards shall be installed in a manner to be fully compliant with the seismic restraint requirements of the North Carolina State Building Code. Provide mounting devices and hardware, bracing, fittings, etc. as required for seismic restraint. See Section 260500, Paragraph 1.23 for additional requirements.

D. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

E. Provide filler plates for unused spaces in panelboards.

F. Provide typed circuit directory for each branch circuit panelboard. Final typed panelboard directories installed in the panelboard door pocket shall include final actual room names and numbers in addition to the general description shown on the panel schedules on the drawings. Revise directory to reflect circuiting changes required to balance phase loads.

G. Provide engraved plastic nameplates under the provisions of Section 260553.

H. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling and below floor. Minimum spare conduits: 5 empty 1 inch. Identify each as SPARE.

I. Ground and bond panelboard enclosure according to Section 260526.

3.02 FIELD QUALITY CONTROL

A. Quality Control: Field inspection, testing and adjusting shall be as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Inspect and test in accordance with NETA ATS, except Section 4, or provide for qualified technicians to perform testing according to the manufacturer's recommendations.

3.03 ADJUSTING

A. Contract Closeout: Adjust installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Measure steady state load currents at each panelboard feeder; rearrange circuits in the panelboard to balance the phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 262726

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall box dimmers.

C. Receptacles.

D. Wall plates.

1.02 DESCRIPTION

Provide wiring devices in types, characteristics, grades, colors and electrical ratings for applications indicated which are UL listed and which comply with NEMA WD 1 and other applicable UL, NEMA and DSCC (Fed Spec) standards.

1.03 RELATED SECTIONS

Section 260534 - Boxes.

1.04 REFERENCES

A. NECA - Standard of Installation.

B. NEMA WD 1 - General Requirements for Wiring Devices.

C. NEMA WD 6 - Wiring Device - Dimensional Requirements.

D. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories (UL 20, 244A, 498, 514C, 1472).

F. DSCC (Fed Spec) W-C-596G.

1.05 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1.06 SUBMITTALS INFORMATION

A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Submit manufacturer's wiring and installation instructions.

C. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

1.07 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum 10 years documented experience.

1.08 WARRANTY

Provide manufacturer's full 1 year warranty minimum, unless specified otherwise.

1.09 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Model HBL1221 Series.
   2. Leviton 1221.
   3. Pass and Seymour PS20AC1.
   4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Description: NEMA WD 1, UL, DSCC, heavy-duty, AC only, general-use, grounding type, back and side wired, single pole, three-way and four-way as indicated, snap switch with hex-head equipment grounding screw. Switches shall have a steel, nickel plated bridge with integral ground, one piece rivetless copper alloy spring contact arm and terminal plate and large silver cadmium oxide contacts. All switches shall have quiet operating mechanisms without the use of mercury switches. All switches shall be approved by a third party agency, approved for the voltage and current indicated.

C. Body and Handle: Gray plastic with toggle handle.

D. Indicator Light: Neon lighted handle type switch; red color handle. Voltage per system rating.

E. Locator Light: Neon lighted handle type switch; green color handle. Voltage per system rating.

F. Ratings:
   1. Voltage: 120-277 volts AC.
   2. Current: 20 amperes.

2.02 WALL BOX LED DIMMERS

A. Manufacturers:
   1. Lutron Nova T dimmer and switch.
   2. Leviton.
   3. Arrow Hart.
   4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Description: Solid-state electronic (0-10V) dimmers; high end minimum of 92% of line voltage; provide voltage compensation to assure flicker free dimming through common voltage variations.

C. Body and Handle: Gray plastic with preset slider.

D. Voltage: 120/277 volts.

E. Rating: Match load shown on drawings.

2.03 RECEPTACLES

A. Manufacturers:
   1. Hubbell Model HBL 5362.
   2. Leviton 5362.
   3. Pass and Seymour 5362A.
   4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Description: NEMA WD 1, UL, DSCC, heavy-duty, 20 ampere, 120 volt, general use, duplex, straight blade, grounding type receptacle arranged for back and side wiring, with separate single or double grounding terminals. Receptacles shall have a full wrap around brass bridge with integral ground and standup double wipe contacts. Self grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.

C. Device Face and Body: Gray nylon or reinforced thermoplastic.

D. Configuration: NEMA WD 6, type as specified and indicated.

E. Convenience Receptacle: Type 5-20R.

2.04 GROUND FAULT CIRCUIT INTERRUPTERS (GFI)

A. Manufacturers:
   1. Hubbell Model GFR8300.
   2. Leviton.
   3. Pass and Seymour.
   4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Description: NEMA WD 1, UL, DSCC, heavy-duty, 20 ampere, 120 volt, general use, duplex, straight blade, grounding type receptacle arranged for back and side wiring, with separate single or double grounding terminals. Receptacles shall have a full wrap around brass bridge with integral ground and standup double wipe contacts. The electronic component's circuit board shall be all glass with a conformal coating. Self grounding or automatic type grounding receptacles are not acceptable in lieu of receptacles with separate grounding screw lugs and a direct, green insulated conductor connection to the equipment grounding system.

C. Device Face and Body: Gray nylon or reinforced thermoplastic.

D. Configuration: NEMA WD 6, type as specified and indicated.

E. Convenience Receptacle: Type 5-20R.

2.05 WALL PLATES

A. Manufacturers:
   1. Hubbell.
   2. Levition.
   3. Pass and Seymour.
   4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Decorative Cover Plate: Single and combination, of types, sizes and with ganging and cutouts as indicated. Provide plates which mate and match with wiring devices to which attached. Material shall be smooth, 0.04" thick, type 302 Stainless Steel as manufactured by the device vendor.

C. Weatherproof Cover Plate: Exterior mounted receptacles, and those noted to be weatherproof, shall be provided with weatherproof PVC transparent cover plates, standard size, and shall be single or ganged as indicated on the contract drawings. Weatherproof plates shall be "approved" third party listed as "raintight while in use".

PART 3 EXECUTION

3.01 EXAMINATION

A. Ensure that outlet boxes are installed at proper height.

B. Ensure that wall openings are neatly cut and will be completely covered by wall plates.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

3.03 INSTALLATION

A. Install in accordance with NECA "Standard of Installation".

B. Install devices vertically, plumb and level.

C. Install switches with OFF position down.

D. Install receptacles with grounding pole on top. Install horizontally oriented receptacles with the grounding pole on the left.

E. Receptacles installed over counters, backsplashes, etc., shall be mounted horizontally.

F. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

G. Do not share neutral conductor on load side of dimmers.

H. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

I. Install decorative plates on switch, receptacle, and blank outlets in finished areas. Schedule installation of finish plates after the surface upon which they are installed has received final finish.

J. Connect switches by wrapping conductor around screw terminal.

K. Connect receptacles by utilizing back wiring provisions only. Do not use side wire terminals.

L. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

M. Provide adhesive backed, laminated plastic receptacle device plate labels identifying the circuit feeding the device. Labels shall be label machine printed to indicate panel and circuit number and shall be Casio, Brother, T&B or approved equal. See Section 260553 for additional requirements

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 260534 to obtain mounting heights specified and indicated on drawings.

B. All wiring devices shall be installed at heights as required by the ADA

C. Install wall switch 48 inches above finished floor, measured to top of device plate.

D. Install convenience receptacle 18 inches above finished floor, measured to bottom of device plate, unless noted otherwise on the Drawings.

E. Install convenience receptacle horizontally 6 inches above backsplash of counter, unless noted otherwise on the Drawings.

F. Install dimmer 48 inches (1.2 m) above finished floor, measured to top of device of plate.

G. Install telecommunications jack 18 inches (450 mm) above finished floor, measured to bottom of device plate, unless noted otherwise on the Drawings.

H. Install telephone jack for side reach wall telephone to position top of telephone at 54 inches (1.4 m) above finished floor, unless noted otherwise on the Drawings.

I. Install telephone jack for forward reach wall telephone to position top of telephone at 48 (1.2 m) above finished floor, unless noted otherwise on the Drawings.

3.05 FIELD QUALITY CONTROL

A. Quality Control. As required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Inspect each wiring device for defects.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify that each receptacle device is energized.

E. Test each receptacle device for correct polarity and for ground continuity.

F. Test each GFCI receptacle device for correct operation.

3.06 ADJUSTING

A. Contract Closeout: Adjust installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Contract Closeout: Clean installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 2727
OCCUPANCY SENSORS

PART 1 GENERAL

1.01 SECTION INCLUDES

Wall box and ceiling type occupancy sensors and accessories.

1.02 RELATED SECTIONS

A. Section 26 0534 - Boxes.

B. Section 26 2726 - Wiring Devices.

C. Section 26 0526 - Grounding.

1.03 REFERENCES

A. NECA - Standard of Installation.

B. NEMA WD 1 - General Requirements for Wiring Devices.

C. NEMA WD 6 - Wiring Device -- Dimensional Requirements.

D. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, ratings and configurations.

1.05 SUBMITTALS FOR INFORMATION

A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Submit manufacturer's installation instructions.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide Products listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 GENERAL

A. The Occupancy Sensor system shall sense the presence of human activity within the spaces indicated and fully control the “On” / “Off” function of the lighting loads automatically. Sensors shall turn “On” the load upon entrance into the room and shall not initiate “On” outside of entrance.

B. Acceptable technology is Passive Infrared (PIR), Ultrasonic and Microphonic. Dual Technology is required utilizing PIR and one of the other technologies.

C. Occupancy sensors shall have a minimum of 2 contacts (1 will be utilized for HVAC control).

D. Sensors shall automatically adjust time delays and sensitivity based on the activity level in the space.

E. All line voltage devices shall be approved third party testing agency listed under Energy Management Equipment, or Industrial Control Equipment. Listing under Appliance Control shall not be accepted.

F. Product shall be manufactured in the USA and be warranted for 5 years.

2.02 WALL BOX LINE & LOW VOLTAGE SENSORS FOR SMALL AREAS

A. Description: Line voltage, single gang, wall mounted occupancy sensor switch with one override or two (as shown) switch(es). Switch shall recess into single gang switch box and fit a standard GFI receptacle plate opening. Switches shall be compatible with standard three and four-way toggle switches. All switches shall be approved by a third party agency, approved for the voltage and current indicated. Provide hard lens switches in storage rooms and other location subject to abuse.

B. Manufacturers
   1. Hubell.
   2. Sensor Switch.
   3. Wattstopper.
   4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

C. Body and Handle: Match device colors specified in Section 26 2726.

D. Ratings:
   Voltage: 120-277 volts AC.
   Minimum Load Rating: 800 watts at 120 VAC, 1200 watts at 277 VAC. Sensors shall be compatible with all load types, including electronic and compact fluorescent ballasts, incandescent or fluorescent and require no minimum load.

2.03 CEILING MOUNTED LOW VOLTAGE SENSORS FOR LARGE AREAS

A. Sensor Switches: Low voltage, recess ceiling mounted occupancy sensor switch. The device shall operate in conjunction with a line voltage power pack to control the connected lighting loads. Sensors shall operate on a class 2, three-conductor system. Multiple sensors shall be connectable to a single power pack. Sensor shall recess into a two gang outlet box. All devices shall be approved by a third party agency, approved for the voltage and current indicated.

B. Manufacturers:
   1. Hubbell.
   2. Sensor Switch.
   3. Wattstopper.
   4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

C. Control units/Power packs: Devices shall be rated 20A at 120-277 volts and shall be compatible with all load types, including LED. They shall have the capacity to power additional remote heads or additional relays. Control relays may be paralleled to accommodate extra load or more than three heads or additional relays. Additional relay shall be used where there is more than one circuit being controlled or where there is a need to control multiple voltages.

D. Manufacturers:
   1. Hubbell.
   2. Sensor Switch.
   3. Wattstopper.
   4. Substitutions: Refer to provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

E. Sensor Body: White plastic, or match device colors specified in Section 26 2726.

PART 3 EXECUTION

3.01 EXAMINATION

A. Ensure that outlet boxes are installed at the proper location.

B. Ensure that ceiling openings are neatly cut and will be completely covered by devices.

C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Install in accordance with NECA "Standard of Installation."

B. Install in locations in accordance with manufacturers recommendation.

C. Install devices vertically, plumb and level.

D. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 0534 to obtain mounting heights specified and indicated on drawings.

B. All wiring devices shall be installed at heights as required by the A.D.A.

C. Install wall switch 48 inches (1.2 m) above finished floor, measured to bottom of outlet box.

3.05 FIELD QUALITY CONTROL

A. Quality Control. As required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Inspect each wiring device for defects.

C. Operate each system with circuit energized and verify proper operation.

3.06 ADJUSTING

A. Contract Closeout: Adjust installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Contract Closeout: Clean installed work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 262813
FUSES

PART 1 GENERAL

1.01 SECTIONS INCLUDED

A. Fuses

1.02 REFERENCES

A. NFPA 70 – National Electric Code.

B. NEMA FU 1 – Low Voltage Cartridge Fuses.

1.03 SUBMITTALS

A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide data sheets showing electrical characteristics including time-current curves.

1.04 PROJECT RECORD DOCUMENTS

A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Record actual fuse sizes.

1.05 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.07 EXTRA MATERIALS

A. Provide no less than 10% of each fuse size and type installed, with a minimum of at least one set of three of each.

B. Provide one fuse puller.

PART 2 PRODUCTS

2.01 FUSE REQUIREMENTS

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. UL Listed.

	Circuit Type	Fuse Type
1.	Service Entrance and Feeder Circuits over 600Amp 200K Amp interrupting rating.	Class L
2.	Service Entrance and Feeder Circuits 600Amp or less 200K Amp interrupting rating.	Class RK1 or J
3.	Motor, Motor Controller and Transformer Circuits 200K Amp interrupting rating.	RK5

D. For individual equipment where fault current does not exceed 50KA use Class K5 fuses with 50KA interrupting rating.

E. Fusible safety switches with short-circuit withstand ratings of 100KA or 200KA require Class R or Class J rejection fuse block feature.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fuses in accordance with manufacturer's instructions.

B. Install fuse with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet in main electrical equipment room or adjacent to the main service equipment.

END OF SECTION

SECTION 26 2816
ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Fusible switches.

B. Nonfusible switches.

1.02 RELATED SECTIONS:

A. Section 26 0529 – Supporting Devices.

B. Section 26 0553 – Electrical Identification.

C. Section 26 2813 – Fuses.

1.03 REFERENCES

A. NECA - Standard of Installation (published by the National Electrical Contractors Association).

B. NEMA FU1 - Low Voltage Cartridge Fuses.

C. NEMA KS1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (published by the International Electrical Testing Association).

E. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide switch ratings and enclosure dimensions.

1.05 SUBMITTALS FOR CLOSEOUT

A. Contract Closeout: Submittals for project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Record actual locations of enclosed switches in project record documents.

1.06 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Cutler Hammer.

B. General Electric.

C. Siemens.

D. Square D Schneider.

E. Substitutions: As permitted in relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

2.02 RATINGS

A. Service Conditions:
   1. Temperature: 104°F. (40°C.).
   2. Altitude: N/A.
   3. Terminal Rating: 75°C. minimum.

B. Minimum Integrated Short Circuit Rating: 10,000 amperes rms symmetrical, or as indicated.

2.03 FUSIBLE SWITCHES ASSEMBLIES

A. Description: NEMA KS 1, heavy duty type with externally operable handle interlocked (defeatable) to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Mechanisms shall be non-teasible, positive, quick make-quick break type. Handle lockable in ON or OFF position. Switches shall have handles whose positions are easily recognizable in the ON or OFF position.

B. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

2.04 NONFUSIBLE SWITCHES ASSEMBLIES

A. Description: NEMA KS 1, heavy duty type with externally operable handle interlocked (defeatable) to prevent opening front cover with switch in ON position, enclosed load interrupter knife switch. Mechanisms shall be non-teasible, positive, quick make-quick break type. Handle lockable in ON or OFF position. Switches shall have handles whose positions are easily recognizable in the ON or OFF position.

B. Provide accessories required by their installation. Provide auxiliary switch contacts as required by other systems. Coordinate with other Divisions as required.

2.05 ENCLOSURES

A. Fabrication: NEMA KS 1.
   1. Interior Dry Locations: Type 1.
   2. Exterior Locations: Type 3R.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with NECA “Standard of Installation”.

B. Switches shall be installed in a manner to be fully compliant with the seismic restraint requirements of the North Carolina State Building Code. Provide mounting devices and hardware, bracing, fittings, etc. as required for seismic restraint. See Section 26 0500, Paragraph 1.23 for additional requirements.

C. Install fuses in fusible disconnect switches serving Division 26 equipment.

D. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.02 FIELD QUALITY CONTROL

A. Quality Control: Field inspection, testing and adjusting as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Inspect and test in accordance with NETA ATS, except Section 4, or provide for qualified technicians to perform testing according to the manufacturer’s recommendations.

END OF SECTION

SECTION 262817
ENCLOSED CIRCUIT BREAKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

Enclosed circuit breakers.

1.02 RELATED WORK

A. Section 260529 - Supporting Devices.

B. Section 260553 - Electrical Identification: Engraved nameplates.

1.03 DEFINITIONS

A. NECA (National Electrical Contractors Association) “Standard of Installation”.

B. NEMA AB 1 - Molded Case Circuit Breakers

C. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Product Data: Provide catalog sheets showing ratings, trip units, time current curves, dimensions, and enclosure details.

C. Manufacturer’s Installation Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with NECA Standard of Installation.

B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.07 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.08 EXTRA MATERIAL

A. Furnish under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Provide three of each size and type current limiter.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cutler Hammer.

B. General Electric.

C. Siemens.

D. Square D.

E. Substitutions: As permitted in relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

2.02 MOLDED-CASE CIRCUIT BREAKERS

A. Circuit Breaker: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles, listed as Type SWD for lighting circuits, Type HACR for air conditioning equipment circuits, Class A ground fault interrupter circuit breakers where scheduled.

B. Service Conditions:
   1. Temperature: 104º F. (40º C.).
   2. Altitude: N/A.
   3. Terminal Rating: 75º C. minimum.

C. Minimum Integrated Short Circuit Rating: 30,000 amperes rms symmetrical, or as indicated.

2.03 PRODUCT OPTIONS AND FEATURES (as specified and as applicable)

A. Provide accessories as scheduled, to NEMA AB 1.

B. Shunt Trip Device: 120 volts AC.

C. Undervoltage Trip Device: 120 volts AC.

D. Auxiliary Switch: 120 volts AC.

E. Alarm Switch: 120 volts AC.

F. Electrical Operator: 120 volts AC.

G. Handle Lock: Include provisions for padlocking.

H. Provide mechanical trip device.

I. Provide insulated grounding lug in each enclosure.ENCLOSURES

2.04 ENCLOSURE

A. Enclosure: NEMA AB 1, Type 1 and 3R, as indicated.

B. Fabricate enclosure from steel.

C. Finish using manufacturer's standard enamel finish, gray color.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install enclosed circuit breakers where indicated, in accordance with manufacturer's instructions.

B. Install enclosed circuit breakers plumb. Provide supports in accordance with Section 260529.

C. Equipment shall be installed in a manner to be fully compliant with the seismic restraint requirements of the North Carolina State Building Code. Provide mounting devices and hardware, bracing, fittings, etc. as required for seismic restraint. See Section 260500, Paragraph 1.22 for additional requirements.

D. Height: 5 ft AFF to operating handle.

E. Provide engraved plastic nameplates under the provisions of Section 260553.

3.02 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Inspect and test each circuit breaker to NEMA AB 1.

C. Inspect each circuit breaker visually.

D. Perform several mechanical ON-OFF operations on each circuit breaker.

E. Verify circuit continuity on each pole in closed position.

F. Determine that circuit breaker will trip on overcurrent condition, with tripping time to NEMA AB 1 requirements.

G. Include description of testing and results in test report.

3.03 ADJUSTING

A. Adjust work under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Adjust trip settings so that circuit breakers coordinate with other overcurrent protective devices in circuit.

C. Adjust trip settings to provide adequate protection from overcurrent and fault currents.

END OF SECTION

SECTION 262923

VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Section includes separately enclosed, pre-assembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.2 RELATED SECTIONS

A. Section 260533 - Raceways and Boxes for Electrical Systems.

B. Section 260526 - Grounding and Bonding.

C. Section 260529 Supporting Devices.

D. Section 260548.16 - Seismic Controls for Electrical Systems.

E. Section 260533 – Conduit.

F. Section 260553 - Electrical Identification.

1.03 DEFINITIONS

A. Retain definition(s) remaining after this Section has been edited.

B. BAS: Building automation system.

C. CPT: Control power transformer.

D. EMI: Electromagnetic interference.

E. IGBT: Insulated-gate bipolar transistor.

F. LAN: Local area network.

G. LED: Light-emitting diode.

H. MCP: Motor-circuit protector.

I. NC: Normally closed.

J. NO: Normally open.

K. OCPD: Overcurrent protective device.

L. PCC: Point of common coupling.

M. PID: Control action, proportional plus integral plus derivative.

N. PWM: Pulse-width modulated.

O. RFI: Radio-frequency interference.

P. TDD: Total demand (harmonic current) distortion.

Q. THD(V): Total harmonic voltage demand.

R. VFC: Variable-frequency motor controller.

1.04 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, and furnished specialties and accessories.

B. Shop Drawings: For each VFC indicated. Include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.

1. Show tabulations of installed devices, equipment features, and ratings. Include the following:

   a. Each installed unit's type and details.
   b. Factory-installed devices.
   c. Enclosure types and details.
   d. Nameplate legends.
   e. Short-circuit current (withstand) rating of enclosed unit.
   f. Features, characteristics, ratings, and factory settings of each VFC and installed devices.
   g. Retain first subparagraph below if specifying modifications in Part 2 articles.
   h. Specified modifications.

2. Schematic and Connection Wiring Diagrams: For power, signal, and control wiring.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Retain first subparagraph below if circuit breakers are specified in VFCs; retain second if field-adjustable overload relays are specified.

2. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and MCP trip settings.

3. Manufacturer's written instructions for setting field-adjustable overload relays.

4. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.

5. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.

1.06 QUALITY ASSURANCE

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.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation, capable of driving full load without derating, under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than 14 deg F (minus 10 deg C) and not exceeding 104 deg F (40 deg C).

2. Ambient Storage Temperature: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)

3. Humidity: Less than 95 percent (noncondensing).

4. Altitude: Not exceeding 3300 feet (1005 m).

B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of electrical systems.

2. Indicate method of providing temporary electrical service.

3. Do not proceed with interruption of electrical systems without Owner's written permission.

4. Comply with NFPA 70E.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.08 COORDINATION

A. Coordinate features of motors, load characteristics, installed units, and accessory devices to be compatible with the following:

1. Torque, speed, and horsepower requirements of the load.

2. Ratings and characteristics of supply circuit and required control sequence.

3. Ambient and environmental conditions of installation location.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Danfoss Inc.; Danfoss Drives Div or comparable product by one of the following:

1. ABB/General Electric.

2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

3. Square D; a brand of Schneider Electric.

B. General Requirements for VFCs: Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.

C. Application: Constant torque and variable torque.

D. VFC Description: Variable-frequency power converter (rectifier, dc bus, and IGBT, PWM inverter) factory packaged in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.

1. Units suitable for operation of NEMA MG 1, Design A and Design B motors as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."

2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."

3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

E. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

F. Output Rating: Three-phase; 10 to 66 Hz, with torque constant as speed changes; maximum voltage equals input voltage.

G. Unit Operating Requirements:

1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.

2. Input AC Voltage Unbalance: Not exceeding 3 percent.

3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.

4. Minimum Efficiency: 95 percent at 60 Hz, full load.

5. Minimum Displacement Primary-Side Power Factor: 95 percent under any load or speed condition.

6. Minimum Short-Circuit Current (Withstand) Rating: 65 kA.

7. Ambient Temperature Rating: Not less than 14 deg F (minus 10 deg C) and not exceeding 104 deg F (40 deg C).

8. Ambient Storage Temperature Rating: Not less than minus 4 deg F (minus 20 deg C) and not exceeding 140 deg F (60 deg C)

9. Humidity Rating: Less than 95 percent (noncondensing).

10. Altitude Rating: Not exceeding 3300 feet (1005 m).

11. Vibration Withstand: Comply with IEC 60068-2-6.

12. Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.

13. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.

14. Speed Regulation: Plus or minus 10 percent.

15. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.

16. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

H. Inverter Logic: Microprocessor based, 16 or 32 bit, isolated from all power circuits.

I. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.

1. Signal: Electrical.

J. Internal Adjustability Capabilities:

1. Minimum Speed: 5 to 25 percent of maximum rpm.

2. Maximum Speed: 80 to 100 percent of maximum rpm.

3. Acceleration: 0.1 to 30 seconds.

4. Deceleration: 1 to 30 seconds.

5. Current Limit: 30 to minimum of 150 percent of maximum rating.

K. Self-Protection and Reliability Features:

1. Coordinate Project-specific self-protection and reliability features with manufacturers, because standard and optional features vary considerably among manufacturers.

2. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.

3. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.

4. Under- and overvoltage trips.

5. Inverter overcurrent trips.

6. VFC and Motor Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor overload alarm and trip; settings selectable via the keypad; NRTL approved.

7. Critical frequency rejection, with three selectable, adjustable deadbands.

8. Instantaneous line-to-line and line-to-ground overcurrent trips.

9. Loss-of-phase protection.

10. Reverse-phase protection.

11. Short-circuit protection.

12. Motor overtemperature fault.

L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

P. Integral Input Disconnecting Means and OCPD: NEMA AB 1, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.

1. Disconnect Rating: Not less than 115 percent of VFC input current rating.

2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.

3. Auxiliary Contacts: NO/NC, arranged to activate before switch blades open.

4. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.

5. NC and NO alarm contact that operates only when circuit breaker has tripped.

2.02 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.

1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.

2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.

   a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Retain first subparagraph below if time and date stamping is not accomplished through the BAS. This is an added-cost option with some listed manufacturers.
2. Real-time clock with current time and date.
3. Running log of total power versus time.
4. Total run time.
5. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).

8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:

1. Electric Input Signal Interface:

a. A minimum of two programmable analog inputs: 4- to 20-mA dc.
b. A minimum of six multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the BAS or other control systems:

a. 0- to 10-V dc.
b. 4- to 20-mA dc.
c. Potentiometer using up/down digital inputs.
d. Fixed frequencies using digital inputs.

3. Output Signal Interface: A minimum of one programmable analog output signal(s) 4- to 20-mA dc), which can be configured for any of the following:

a. Output frequency (Hz).
b. Output current (load).
c. DC-link voltage (V dc).
d. Motor torque (percent).
e. Motor speed (rpm).
f. Set point frequency (Hz).

F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.

1. Number of Loops: One.

G. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display VFC status and alarms. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.

1. Network Communications Ports: Ethernet and RS-422/485.

2. Embedded BAS Protocols for Network Communications: Echelon LonWorks; protocols accessible via the communications ports.

2.03 LINE CONDITIONING AND FILTERING

A. Provide filtering at drive that will provide IEEE 519 at the drive terminals.

2.04 BYPASS SYSTEMS

A. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor and retransfer shall only be allowed with the motor at zero speed.

B. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter input and output and permit safe testing and troubleshooting of the power converter, both energized and de-energized, while motor is operating in bypass mode.

1. Bypass Contactor: Load-break, NEMA-rated contactor.

2. Input and Output Isolating Contactors: Non-load-break, NEMA-rated contactors.

3. Retain "Isolating Switch" Subparagraph below if retaining first option in last "Bypass Controller" Paragraph above.

4. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.

C. Bypass Contactor Configuration: Full-voltage (across-the-line) type.

1. NORMAL/BYPASS selector switch.

2. HAND/OFF/AUTO selector switch.

3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.

4. Contactor Coils: Pressure-encapsulated type.

a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.

b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.

5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.

a. CPT Spare Capacity: 50 VA.

6. Overload Relays: NEMA ICS 2.

a. Solid-State Overload Relays:

1) Switch or dial selectable for motor-running overload protection.
2) Sensors in each phase.
3) Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

4) Retain one or both of first two subparagraphs below if applicable. These are optional, added-cost features.
5) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
6) Analog communication module.

b. External overload reset push button.

2.05 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1

2.06 ACCESSORIES

A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.

1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, type.

a. Push Buttons: Recessed types; momentary.
b. Pilot Lights: LED types; push to test.
c. Selector Switches: Rotary type.
d. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.

B. Reversible NC/NO bypass contactor auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.

2.07 SOURCE QUALITY CONTROL

A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.

1. Test each VFC while connected to its specified motor.

B. VFCs will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Coordinate layout and installation of VFCs with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Wall-Mounting Controllers: Install VFCs on walls with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Supporting Devices."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

E. Comply with NECA 1.

3.03 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.

2. Label each VFC with engraved nameplate.

3. Label each enclosure-mounted control and pilot device.

3.04 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices and facility's central-control system. Comply with requirements in Section 260519 "Building Wire and Cable."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic control devices where applicable.

3.05 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. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation.

2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.

3. Test continuity of each circuit.

4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer/Owner before starting the motor(s).

5. Test each motor for proper phase rotation.

6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

7. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. VFCs will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.06 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.

3.07 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to six times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer/Owner before increasing settings.

3.08 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.09 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION

SECTION 264313
SURGE PROTECTION DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

Section includes field-mounted SPDs for low-voltage (120 to 480 V) power distribution and control equipment.

1.02 RELATED SECTIONS:

A. Section.260533 – Raceway and Boxes for Electrical Systems.

B. Section 260526 - Grounding and Bonding.

C. Section 260529 Supporting Devices.

D. Section 260533 – Conduit

E. Section 260548.16 – Seismic Controls for Electrical Systems.

F. Section 260553 - Electrical Identification.

1.03 DEFINITIONS

A. Surge protective device (SPD).

B. Voltage protection rating (VPR)

C. Normal discharge current (I_N)

D. Maximum continuous operating voltage (MCOV)

E. Mode, or Mode of Protection (L-N, L-G, L-N & L-L)

F. Metal-Oxide Varistor (MOV)

G. Over-Current Protective Device (OCPD)

H. Short-Circuit Current Rating (SCCR)

I. Nationally Recognized Testing Laboratory (NRTL) e.g., UL, ETL, CSA, etc.

J. VZCA – a UL code category covering enclosed and open-type surge-protective devices (SPDs) designed for repeated limiting of transient-voltage surges as specified in the standard on 50 or 60 Hz power circuits not exceeding 1000 V AC or 1500 V DC, including photovoltaic applications (PV SPDs)

1.04 REFERENCES

A. SPD units and all components shall be designed, manufactured, and tested in accordance with the following latest standards:
   1. ANSI/UL 1449 Standard for Safety, Surge Protective Devices, 5th Ed.
   2. ANSI/UL 1283 Standard for Safety, Electromagnetic Interference Filters, 5th Ed.
   3. NFPA 70 National Electrical Code
   4. NFPA 780 Standard for the Installation of Lightning Protection Systems
   5. UL 96A Standard for Safety, Installation Requirements for Lightning Protection Systems, 12th Ed.

1.05 SUBMITTALS

A. Manufacturer's technical data sheet containing the following information for each product type:
   1. Model/Catalog Number
   2. Surge Current Rating (kA/phase and kA/mode)
   3. System Voltage
   4. SPD Type (1 or 2)
   5. Nominal Discharge Current Rating (I_N)
   6. Mode of Protection (L-N, L-G, L-N & L-L)
   7. Voltage protection rating (VPR)
   8. OCPD Requirements
   9. System Frequency
   10. NEMA 250 Enclosure Type
   11. Dimensions
   12. Weights

B. A Copy of manufacturer's UL 1449 Category Code VZCA published data file showing the model/catalog number and UL assigned values for "b" through "h" above

C. Provide verification that submitted SPDs comply with ANSI/UL 1449 Standard for Safety, Surge Protective Devices, 5th Edition in the form of the manufacturer's UL file number that can be verified on UL's website (www.ul.org), and/or a direct hyperlink to the manufacturer's UL 1449 Category Code VZCA file on the UL website.

D. Manufacturer's product(s) installation instructions and warranty statement.

1.06 QUALIFICATIONS

A. For the equipment specified herein, the manufacturer shall be ISO 14001 and ISO 9001 or 9002 certified.

B. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2011/65/EU and have a visible label showing compliance.

C. The SPD shall be UL 1449 5th Ed Listed, with a Nominal Discharge Current (I_N) rating of 20 kA, and shall be a Type 1 or Type 2 for use in UL 96A systems as required.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. ABB/General Electric

B. Eaton Corporation SPD Series (Basis of Design)

C. Schneider/Square D

D. Siemens

Note: The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above shall meet these specifications herein in their entirety. Products in compliance with the specification and manufactured by others not named herein shall be considered.

	VOLTAGE CONFIGURATION		
MODES OF PROTECTION	208Y/120	480Y/277	120/240
L-N, L-G, N-G	700 V	1200 V	700 V
L-L	1200 V	2000 V	1200 V

2.02 SURGE PROTECTION DEVICES (SPDs)

A. Operating Voltage – refer to drawings for SPD(s) operating voltage configuration.

B. Maximum Continuous Operating Voltage (MCOV) – the MCOV shall not be less than 115% of the nominal system operating voltage

C. The suppression system shall incorporate thermally-protected metal-oxide varistors (MOVs) as the core surge suppression component for all surge protective devices

D. The system shall not utilize silicon avalanche diodes (SADs) or selenium cells

E. SPD end-of- life mode to be a benign, open circuit event. Devices utilizing an end-of-life, (potentially violent) short-circuit failure mode shall not be accepted.

F. The system shall not utilize spark-gap devices, or any components that can crowbar the system voltage leading to a complete system voltage loss to all connected, downstream loads.

G. SPDs shall operate without the need for an external overcurrent protection device (OCPD), and must be UL Listed as such. SPDs must not require an external OCPD or an internal replaceable OCPD to enable the manufacturer to obtain their UL product Listing.

H. Protection Modes – The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	PROTECTION MODES			
VOLTAGE CONFIGURATION TYPE	L-N	L-G	N-G	L-L
WYE	•	•	•	•
DELTA	N/A	•	N/A	•
SINGLE (SPLIT) PHASE	•	•	•	•
HIGH-LEG DELTA	•	•	•	•

I. Nominal Discharge Current (IN) – All SPDs applied to the distribution system shall have a 20 kA IN rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20 kA shall be rejected

J. ANSI/UL 1449 5th Edition Voltage Protection Rating (VPR) shall not exceed the following:

K. Balanced Suppression Platform – The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable single-mode modules shall not be accepted

L. SPDs containing items such as single-mode replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

M. Electrical Noise Filter – Each Type 2 SPD shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method
   1. Type 1 units shall not contain filtering or have a UL 1283 5th Edition Listing
   2. Type 2 units with filtering shall conform to UL 1283 5th Edition Listing

N. Internal Connections – No plug-in single-mode modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors

O. Monitoring Diagnostics – Each SPD shall provide the following integral monitoring options:
   1. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase
      a. For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted
      b. The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted
   2. Form C dry-relay contacts (optional) - The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition
   3. Audible Alarm and Silence Button (optional) – The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated

P. Thermally-Protected Metal-oxide Varistors (MOVs)
   1. The unit shall contain thermally protected MOVs. These self-protected MOVs shall have a thermal protection element integrated with the MOV and a mechanical disconnect with arc quenching capabilities in order to achieve overcurrent protection of the MOV. The thermal protection assembly shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition

Q. Overcurrent Protection
   1. The unit shall not require external overcurrent protection as part of the UL 1449 listing. Local electrical code may require overcurrent protection of the conductors connecting the SPD to the system. OCPD shall be sized based on local electrical code requirements.

R. Enclosures
   1. All enclosed equipment shall have either NEMA 250 Type 1, Type 4, or Type 4X (stainless steel) enclosures as suitable for locations indicated on the drawings and as described below:
      a. NEMA 250 Type 1 (interior locations) – Constructed of ANSI 61 painted steel, intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
      b. NEMA 250 Type 4 (exterior locations) – Constructed of ANSI 61 painted steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure.
      c. NEMA 250 Type 4X (exterior locations, corrosive environment) – Constructed of 304 stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection.

2.03 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, MCC, switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

2.04 SERVICE ENTRANCE REQUIREMENTS

A. Surge Current Rating – 400 kA per phase/200 kA per mode

B. Nominal Discharge Current Rating (IN) – 20 kA

C. SPD Type 1 or 2

D. UL 1449 5th Edition Listed

E. Short-circuit current rating complying with UL 1449 5th Ed and matching or exceeding the panelboard short-circuit rating and redundant suppression circuits; with individually fused metal-oxide varistors

F. Power and protection status indicator LEDs

G. Audible alarm, with silencing switch, to indicate when protection has failed

H. N/O, N/C Form C dry-relay contacts for remote potential monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

2.05 DISTRIBUTION PANELBOARD REQUIREMENTS

A. Surge Current Rating – 300 kA per phase/150 kA per mode.

B. Nominal Discharge Current Rating (IN) – 20 kA

C. SPD Type 2

D. UL 1449 5th Edition Listed

E. Short-circuit current rating complying with UL 1449 5th Ed and matching or exceeding the panelboard short-circuit rating and redundant suppression circuits; with individually fused metal-oxide varistors

F. Power and protection status indicator LEDs

G. Audible alarm, with silencing switch, to indicate when protection has failed

H. N/O, N/C Form C dry-relay contacts for potential remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system

2.06 SUBPANEL/BRANCH CIRCUIT PANELBOARD REQUIREMENTS

A. Surge Current Rating – 200 kA per phase/100 kA per mode.

B. Nominal Discharge Current Rating (IN) – 20 kA

C. SPD Type 2

D. UL 1449 5th Edition Listed

E. Short-circuit current rating complying with UL 1449 5th Ed and matching or exceeding the panelboard short-circuit rating and redundant suppression circuits; with individually fused metal-oxide varistors

F. Power and protection status indicator LEDs

G. Audible alarm, with silencing switch, to indicate when protection has failed

H. N/O, N/C Form C dry-relay contacts for potential remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of UL, IEEE, and NEMA standards

3.02 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer's recommendations, applicable electrical codes and the contract drawings.

B. Do not energize or connect electrical equipment to their sources until SPDs are installed and connected.

C. Do not perform insulation resistance tests of the distribution wiring equipment with the SDP installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.03 WARRANTY

A. The manufacturer shall provide a ten (10) year warranty (15 year warranty with product registration) that covers replacement of the complete unit (including lightning) from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local electrical code

END OF SECTION

SECTION 265100
INTERIOR LUMINAIRES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior solid-state luminaires that use LED technology.

B. Building mounted exterior luminaires.

C. Luminaire accessories.

1.2 RELATED SECTIONS

A. Section 260533 - Conduit.

B. Section 260519 - Building Wire and Cable.

C. Section 260534 - Boxes.

D. Section 260526 - Grounding and Bonding.

E. Section 260553 - Electrical Identification.

F. Section 262726 – Wiring Devices.

1.3 DEFINITIONS

A. Retain terms that remain after this Section has been edited for a project.

B. CCT: Correlated color temperature.

C. CRI: Color Rendering Index.

D. Fixture: See "Luminaire."

E. IP: International Protection or Ingress Protection Rating.

F. LED: Light-emitting diode.

G. Lumen: Measured output of lamp and luminaire, or both.

H. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Submittal information will include IES and Photometric files with the fixture specifications. IES Photometric and LM79 data for the submitted LED fixtures, IES file must been from an NVLAP

(National Voluntary Laboratory Accreditation Program) accredited laboratory. Submittal information will also include a referenced location for a current installation of the proposed products where the operational performance of these proposed products can be observed and evaluated by the Owner. Provide photometric calculation for the following:

1. Each interior floor plan with emergency lighting fixtures only.
2. Exterior plan with emergency lighting fixtures only.

1.5 SUBMITTALS FOR INFORMATION

A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 SUBMITTALS FOR CLOSEOUT

A. Contract Closeout: Submittals for project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Submit manufacturer's operation and maintenance instructions for each product.

1.7 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Conform to requirements of NFPA 101.

C. Lighting systems shall comply with the 2018 North Carolina State Energy Code and North Carolina Senate Bill 668.

D. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

B. Lighting equipment shall be installed in a manner to be fully compliant with the seismic restraint requirements of the North Carolina State Building Code. Provide mounting devices and hardware, bracing, fittings, etc. as required for seismic restraint. See Specifications Section 260500, Paragraph 1.23 for additional requirements.

C. Where a recessed or downlight fixture replaces a section or part of an acoustical ceiling tile, or a section or part of a suspended gypsum board ceiling, the fixture shall be supported at two (2) diagonal corners to the steel frame of the building. Supports shall be provided with the same type of wire as used to support the lay-in ceiling track or GWB ceiling system. Attach one end of the wire to one corner of the fixture and the other end to the building's structural system. The lay-in or flange fixture shall then be screwed to the main runners of the lay-in ceiling track or GWB ceiling system at all four (4) corners using sheet metal screws (parabolic type fixtures shall be attached to the ceiling grid with approved clips). The Electrical Contractor shall be responsible for coordination work with the ceiling contractor; however, the ceiling contractor will provide framed openings for reception of lighting fixtures. All recessed fixtures shall be furnished with all necessary mounting accessories.

D. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

F. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts or screws.

G. Install recessed luminaires to permit removal from below.

H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Install wall mounted luminaires, emergency lighting units and exit signs at height as indicated on Drawings.

J. Install accessories furnished with each luminaire.

K. Connect luminaires, emergency lighting units and exit signs to branch circuit outlets provided under Section 260534 using flexible conduit.

L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Install/provide specified lamps/LEDs in each emergency lighting unit, exit sign, and luminaire.

3.2 FIELD QUALITY CONTROL

A. Quality Assurance: Field inspection, testing and adjusting shall be as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Contract Closeout: Adjust installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Aim and adjust luminaires as directed.

3.4 CLEANING

A. Contract Closeout: Clean installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.5 DEMONSTRATION AND INSTRUCTIONS

A. Contract Closeout: Demonstrate installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Demonstrate luminaire operation for minimum of two hours.

3.6 PROTECTION OF FINISHED WORK

A. Contract Closeout: Protect installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Relamp luminaires that have failed lamps at Substantial Completion. Replace LED modules in which more than 5% of the LEDs have failed lamps at Final Acceptance of the Work.

END OF SECTION

SECTION 265200

EMERGENCY AND EXIT LIGHTING

PART 1 GENERAL

1.1 SUMMARY

Section includes emergency exit lighting and emergency egress lighting units, LED emergency drivers, lighting inverters and transfer switching devices.

1.2 STANDARDS

A. UL 924

B. NFPA 101 - Life Safety Code.

C. NFPA 70 - National Electrical Code.

D. North Carolina State Building Code including Energy Code Volume X.

E. NEMA - Standards

1.3 SUBMITTALS FOR REVIEW

A. Submittals: Procedures for submittals. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

1.4 SUBMITTALS FOR INFORMATION

A. Submittals: Submittals for information. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.5 SUBMITTALS FOR CLOSEOUT

A. Contract Closeout: Submittals for project closeout. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Submit manufacturer's operation and maintenance instructions for each product.

1.6 QUALIFICATIONS

Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.7 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Conform to requirements of NFPA 101.

C. Products: Listed and classified by testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated. Products shall also meet or exceed the standards listed in Part 2.

PART 2 PRODUCTS

2.1 GENERAL

A. All lighting fixtures shall be listed as emergency lighting equipment and approved by third party testing agencies and NFPA and shall bear their label.

B. All fixtures shall have a stock, or standard finish unless otherwise specified.

C. All fixtures shall be completely self-contained, provided with maintenance free battery, automatic charger and other features. They shall be installed complete with lamps, batteries, etc. which shall be new and unused at time of final inspection of the project for acceptance.

D. Lighting fixture types shall be furnished as required by the Lighting Fixture Schedule on the contract drawings and as herein specified. Catalog numbers are provided as a guide to the design and quality of fixture desired. Equivalent designs and equal quality fixtures of other manufacturers listed will be acceptable upon approval of the Architect/Engineer. The Contractor shall verify from the contract drawings the type of ceilings or walls the fixture is to be used with and shall provide compatible mounting attachments and trim. Provide all accessories or additional materials required to maintain the ceiling fire rating as required by regulatory authorities.

E. Emergency lighting fixtures shall be as shown on the lighting fixture schedule on the contract drawings, and as herein specified.

F. Warranty: The entire unit shall be warranted for three years. The battery must have a additional two more years pro-rated warranty. Warranty shall date from the date of final project acceptance and be included in the contract document.

2.2 EMERGENCY LIGHTING (EGRESS) UNITS

A. Product Description: Self-contained LED emergency lighting unit automatically activated when the line voltage drops below 80%.

B. Battery: Ten year normal life expectancy, 6 or 12 volt, sealed, maintenance-free, lead calcium type, with 1.5 hour minimum capacity at full load. Battery shall be a high temperature type with an operating range of 0° C. to 60º C., contain a resealable pressure vent and sintered positive and negative terminals. A low voltage disconnect switch shall be included if a lead battery is used, to disconnect the battery from the load and prevent damage from a deep discharge during an extended power outage.

C. Battery Charger: Automatic, solid state, full wave rectification, surge protected, current-limiting, dual-rate type, with filtered output of sufficient capacity to recharge discharged battery to full charge within twelve hours. Provide fused output circuit, low voltage battery disconnect, brownout and short circuit protection. Thermal protection shall sense circuitry temperature and adjust charge current to prevent overheating and charger failure. Thermal compensation shall adjust charger output to provide optimum charge voltage relative to ambient temperature. Regulated charge voltage shall maintain constant charge voltage over a wide range of line voltages. AC lockout circuit shall allow battery connection before AC power is applied and prevent battery damage due to deep discharge.

D. Lamps: LED. Heads shall rotate for aiming. Maximum LED failure rate shall be 25% within a seven (7) year period; otherwise, if exceeded, manufacturer shall replace the complete unit at no charge to the Owner.

E. Mounting: Surface wall or recessed ceiling as indicated by the drawings.

F. Housing: White polycarbonate, with steel backbox/housing or steel with white finish. Wall mount unit with hinged faceplate and adjustable mounting hardware. Ceiling mount unit with T bar hangar kit.

G. Self-Diagnostics: Electronics shall automatically, or manually upon demand, conduct self test on battery condition (including actual discharge), charger, lamps and internal wiring integrity per NEC and NFPA at prescribed intervals. A pilot light shall indicate the unit is connect to AC power. Provide test switch and visual indicator(s) of unit operational condition including charger status, ready and service code. Test switch shall simulate operation of the unit upon loss of AC power by energizing lamps from the battery, and also exercise the transfer relay.

H. Electrical Connection: Conduit connection.

I. Input Voltage: Dual voltage input (120/277 volts).

2.3 LED EMERGENCY DRIVER

A. Product Description: Manufacturer-installed UL924 LED emergency battery power supply suitable for installation in LED luminaire wireway. When normal AC power fails, the unit shall immediately drive the LED load at a reduced light output for a minimum of 90 minutes. When AC power is present, the emergency LED driver shall operate in various charging modes to ensure the sealed, maintenance-free, high-temperature nickel-cadmium batteries are fully recharged within 24 hours after a full discharge and remain fully charged until the next loss of AC power.

B. Battery: Seven to ten year normal life expectancy, 9.6 volt, sealed, maintenance-free, nickel-cadmium type, with 1.5 hour minimum capacity at 10 watts output. Battery shall be a high temperature type with an operating range of 32° F. to 122º F.

C. Provide with self-diagnostics module with status indicator light and test switch. Self-diagnostics shall automatically, or manually upon demand, conduct self test on battery condition (including actual discharge), charger, LEDs and internal wiring integrity per NEC and NFPA at prescribed intervals. Status light shall indicate operational condition including charger status, ready and service code. Test switch shall simulate operation of the unit upon loss of AC power by energizing lamps from the battery.

D. Input Voltage: Dual voltage input (120/277 volts)

2.4 EXIT LIGHTING UNITS

A. Product Description: Self-contained exit lighting unit automatically activated when the line voltage drops below 80%.

B. Battery: Ten year normal life expectancy, 6 or 12 volt, sealed, maintenance-free, lead calcium type, with 1.5 hour minimum capacity. Battery shall be a high temperature type with an operating range of 0º C. to 60º C. and contain a resealable pressure vent and sintered positive and negative terminals. A low voltage disconnect switch shall be included if lead battery is used, to disconnect the battery from the load and prevent damage from a deep discharge during an extended power outage.

C. Battery Charger: Automatic, solid state, surge protected, full wave rectification, current-limiting, dual-rate type, with filtered output of sufficient capacity to recharge discharged battery to full

charge within twelve hours. Provide fused output circuit, low voltage battery disconnect, brownout and short circuit protection. Thermal protection shall sense circuitry temperature and adjust charge current to prevent overheating and charger failure. Thermal compensation shall adjust charger output to provide optimum charge voltage relative to ambient temperature. Regulated charge voltage shall maintain constant charge voltage over a wide range of line voltages. AC lockout circuit shall allow battery connection before AC power is applied and prevent battery damage due to deep discharge.

D. Lamps: LED, discrete or diffuse. Maximum failure rate shall be 25% within a seven year period, otherwise, if exceeded the manufacturer shall replace the entire unit at no cost to the Owner.

E. Face:
   1. Standard Unit: Single or dual face as indicated or required. Translucent plastic face with red letters on white background.
   2. Architectural/Edge Lit Unit: Clear transparent plastic panel with red letters on clear or mirrored background.

F. Directional Arrows: As indicated or universal type for field adjustment.

G. Mounting: Universal, surface wall, back or end mount, or ceiling, top or pendant mount.

H. Housing: White polycarbonate for standard unit, metallic enclosure with clear plexiglass signage panel for architectural/edge lit unit.

I. Self-Diagnostics: Electronics shall automatically, or manually upon demand, conduct self test on battery condition (including actual discharge), charger, lamps and internal wiring integrity per NEC and NFPA at prescribed intervals. Provide test switch and visual indicator(s) of unit operational condition including charger status, ready and service code. Test switch shall simulate operation of the unit upon loss of AC power by energizing lamps from the battery. This simulation shall also exercise the transfer relay.

J. Electrical Connection: Conduit connection.

K. Input Voltage: Dual voltage input (120/277 volts).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install suspended exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend sign at indicated height.

B. Install surface-mounted emergency lighting units and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

C. Install wall-mounted emergency lighting units and exit signs at height as indicated.

D. Install accessories furnished with each emergency lighting unit and exit sign.

E. Emergency and exit lighting fixtures shall be installed in a manner to be fully compliant with the seismic restraint requirements of the North Carolina State Building Code. Provide mounting devices and hardware, bracing, fittings, etc. as required for seismic restraint. See Specifications Section 260500, Paragraph 1.23 for additional requirements.

F. Connect emergency lighting units and exit signs to branch circuit outlets provided under this Division as indicated.

G. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling grid members using bolts or screws.

H. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within unit.

I. Install specified lamps in each emergency lighting unit.

J. Ground and bond emergency lighting units and exit signs under the provisions of Section 260526.

K. Locate exit and emergency lighting fixtures as indicated on reflected ceiling plan.

L. Install recessed luminaires to permit removal from below.

M. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

N. Install screws to secure recessed grid-supported luminaires in place.

O. Install accessories furnished with each luminaire.

P. Paint a 3/8” diameter red dot on each emergency lighting fixture to provide ready identification of emergency fixtures. Exact location shall be coordinated with the Architect/Engineer.

3.2 FIELD QUALITY CONTROL

A. Quality Assurance: Field inspection, testing and adjusting shall be as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

A. Contract Closeout: Adjust installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Aim and adjust emergency lighting fixture heads to illuminate paths of egress.

3.4 CLEANING

A. Contract Closeout: Clean installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.5 DEMONSTRATION AND INSTRUCTIONS

A. Contract Closeout: Demonstrate installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. The Contractor shall 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, in accordance with NEC 700. Any unit which fails the test must be repaired or replaced, and tested again. A copy of the test report shall be presented at final inspection and included in the Owner's Operation and Maintenance Manual. Include starting voltage, ending voltage, and percent voltage drop in the test report. The Architect/Engineer will provide the testing form for contractor use.

3.6 PROTECTION OF FINISHED WORK

A. Contract Closeout: Protect installed work as required under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Relamp emergency lighting units and exit signs that have failed lamps at Substantial Completion. Replace exit signs in which more than 5% of the LEDs have failed lamps at Substantial Completion.

END OF SECTION

DIVISION 27 – COMMUNICATIONS
27 00 00 COMMUNICATIONS

27 01 00 OPERATION AND MAINTENANCE OF COMMUNICATION SYSTEMS

ARCHITECTURAL ISSUES RELATED TO TECHNOLOGY

TELECOMMUNICATION ROOMS

- The typical telecommunications infrastructure for a building is designed based upon telecommunications rooms located throughout the facility. These rooms house wiring cross-connect panels as well as network electronics needed for voice, data, security camera systems, and intercom systems.
- Each building has one Equipment Room (ER), and possibly one or more Telecommunication Rooms (TR) located elsewhere in the building.
- The minimum requirements ER for square footage in new construction are as follows:
    - Elementary School 200 Square Feet
    - Middle School 300 Square Feet
    - High School 400 Square Feet
- The minimum TR square footage requirements for new construction is 10’ wide x 8’ deep and minimum 10’ wide x 8’ deep for renovation projects.
- Doors are to be designed so they do not open into the TR space.
- The designer should include a floor plan for the ER within the project drawings. This floor plan should show type and locations (dimensioned) of equipment racks, overhead ladder racks, and all wireways and conduits that enter the room.
- The ER serves as the connection point between the entrance and riser cabling systems.
- The ER serves as the connection point between the riser and horizontal cabling systems. In most cases the ER also serves as one of the TRs (an originating point of horizontal cabling serving its own geographic zone)
- Each TR serves as the hub for a particular geographic zone of the building (i.e. floor or wing).
- In addition, controller-type equipment for auxiliary building systems which require either dial tone or network connections may be located in the ER/TRs with permission from the owner. These include fire alarm dialers, security system controllers, building automation system controllers, and other similar devices.
- Determination if other communications related equipment may be installed in the ER/TR will be done on a case by case basis. Occupants who desire to house other equipment in these rooms should contact the NHCS Facilities, Maintenance and Technology Departments for approval and coordination.
- Room location selection. When possible, the ER should be located on the first floor in the middle of a building with TRs stacked on each floor directly above it. In some larger buildings, multiple stacks of TRs will be required. One key limiting factor in determining acceptable locations for ER/TR is that current data communications technologies require that the length of the horizontal data cable link does not exceed 295 ft. (90m). A good rule of thumb to use in determining acceptable locations is the “250 ft. rule”. The pathway runs from the outlet box farthest from an ER/TR back to where the wireway penetrates the wall of that

ER/TR should not exceed 250 ft. It is imperative that this calculation include allowances for the vertical conduit run from the wireway to the outlet box and for the vertical and horizontal deviations in the wireway routing which are common in construction projects. Since the selection of ER/TR locations will probably be done prior to specifying the exact routing of the pathway system, the designer is encouraged to use conservative estimating in determining maximum length of runs.

- ❑ Typically, ER/TR are located near the center of the building adjacent to other core service spaces.
- ❑ Unacceptable locations. ER/TR should not be located in areas subject to water infiltration, steam infiltration, excessive humidity from nearby operations, excessive heat, or direct sunlight (rooms should not have windows). They should also not be located too close to sources of significant EMI or hazardous substances.
- ❑ Room administration. The owner has final authority over access to, and the use of, all ER/TR.
- ❑ Security. All ER/TR will be keyed to the owner's discretion. A limited number of keys will be provided to parties who require access on an ongoing basis.
- ❑ Accessibility. The designer should locate the ER/TR such that they can be easily accessed by technicians without having to pass through lockable space. Typically, each will be located with a door exiting to a corridor or common area which can be reached by personnel possessing keys to the main building entrance door only. It is acceptable to locate these rooms with the door directly accessing the exterior of a building. However, extra effort must be made to ensure these doors are sealed properly from water, dirt, dust, and heat potentially present outside buildings.
- ❑ Locating the doors of the ER/TR so that they are to be entered from mechanical, electrical, or other similar space is unacceptable. Doors of ER/TR should not be blocked by furniture or equipment, vending machines, trash or recycling bins, or other movable equipment restricting quick access by technicians.
- ❑ General construction. ER/TR can be constructed with materials similar to those used for basic office space construction, and can be matched to nearby spaces. In retrofit projects, these rooms should be constructed to match surrounding areas as closely as possible.
- ❑ Walls. The walls of each room should be installed to the deck above. Typically, walls will be constructed using 3 5/8" steel studs (25 GA at walls, 20 GA around door) at 16" O.C. with one layer of 5/8" thick type X (ASTM C-36) gyp-board each side. 4" rubber cover base should be installed on all walls inside the room.
- ❑ Ceilings. The minimum height for ceilings in the ER/TR should be 9' – 0". However, when allowable by fire code, no ceiling should be installed in the rooms, and the walls should be run to the deck above. Where existing utilities prevent walls from being run to the deck or where a ceiling is required to maintain a particular fire rating, the ceiling should be installed as high as possible.
- ❑ Fire rating. In general, the walls of an ER/TR do not need to be fire rated assemblies. However, if any wall of the room is required to be a rated wall (i.e. the wall between the ER/TR and the corridor, or the wall between the ER/TR and a stairwell), that wall should be installed to comply with the rating required. The fire rating of the ceiling and floor of a ER/TR is no different than that required for similar occupied space.
- ❑ Interior doors. Doors should swing out, not into the ER/TR. Doors and frames should match

surrounding doors as closely as possible.

- ❑ Seals. It is important that moisture and dust be kept out of ER/TR. The electronics in these rooms are equipped with fans which pull in air to cool internal components. Excess moisture or dust will damage this equipment over time. The bottom of interior doors should be equipped with door shoes, solid door sweeps, brush door sweeps, or thresholds equipped with vinyl inserts as applicable to prevent water and dust from entering the room underneath the door.
- ❑ Flooding. Typically, the ER is located in an area on the lowest floor of a building. However, this can create significant problems if this area is subject to flooding. When possible, the designer may consider locating the ER on a higher level (first floor as opposed to basement). In extreme cases, the designer may elect to have a floor drain installed just outside the ER with the ER floor sloped properly to allow drainage.
- ❑ Another potential source of flooding in the ER occurs when the first telecommunications manhole outside the building is at a higher elevation than the ER. Storm water collects in the manhole and gravity forces it through the entrance duct bank. While installation of water tight sealant inside the conduits usually prevents flooding, the ER finished floor should be located higher than the top of the manhole, when feasible.
- ❑ Interior/finishes. The interior of each ER/TR should be completely painted with two coats of latex paint. Floors should be finished with 12” x 12” commercial grade vinyl composition tiles.
- ❑ ¾” thick plywood is to be installed, on the wall behind the equipment racks, from 24” to 96” AFF. Plywood is to be either fire retardant plywood with label side out or standard plywood painted with fire retardant white paint. If fire retardant plywood is used, the contractor shall have the designer approve the completed installation prior to the plywood being painted with the latex paint described above. If fire retardant paint is used, the contractor shall paint all sides of the plywood. The contractor shall also provide a product submittal for the paint to the designer for approval.
- ❑ If needed, voice riser cables. Route riser cables from entry point into ER/TR to nearest ladder rack. Fasten cables to overhead ladder racks to reach equipment racks where cables are to be terminated. Install an additional 10ft. cable slack loop in the cable run, and fasten to overhead ladder racks. Route cables neatly, parallel to each other, and secure with Velcro-type cable wraps to the ladder rack.
- ❑ Install cables down from ladder racks inside 12” vertical U-channels in equipment racks to reach locations where cables are to be terminated. Attach cables to channels with rack loop straps. Allow for 6” drop slack loop after termination.
- ❑ Fiber optic riser cables. Route fiber optic cables from entry point into ER/TR to nearest ladder rack. Fasten cables to overhead ladder racks to reach equipment racks where cables are to be terminated. Install an additional 10ft. (minimum) cable slack loop in the runs and fasten to overhead ladder racks, securing with Velcro cable ties to the ladder rack.
- ❑ Install inner-duct down from ladder racks inside vertical U-channels in equipment racks to reach housings where cables are to be terminated. Attach inner-ducts to channels with rack loop straps. Stop inner-duct runs just above the uppermost closet connector housing in the equipment rack, and extend fiber cable into the housing for termination. Use velcro-type cable wraps as required to neatly secure fiber optic cables once they exit the inner-duct.

27 01 10 Operation and Maintenance of Structured Cabling and Enclosures

- ❑ The designer should include a floor plan for the ER/TRs within the project drawings. This floor plan should show type and locations (dimensioned) of equipment racks, overhead ladder racks, and all wireways and conduits that enter the room.
- ❑ The placement of equipment racks in each ER/TR should be specified such as to allow maximum possible access to equipment by technicians. Where possible, do not place racks in front of wall mounted interface equipment. In general, racks should be positioned in a line abreast with a 12" space left between racks, and parallel to the longest wall of the ER. When possible, a minimum of 36” should be left between the cable management channel on each end of the line of racks and the wall. If this is not possible, the channel on one end of the line of racks should be positioned directly adjacent to one wall of the room with maximum space (36” min.) remaining at the opposite end of the line of racks. The minimum clearance from the rear of an equipment rack to the wall should be 36”. A minimum of 36” should be maintained between the front of the equipment rack and any extended equipment mounted on the facing wall.
- ❑ The number and type of equipment racks installed in a specific ER/TR will be based on the number of outlets projected to be wired back to that ER/TR and the electronics required to support those outlets. This number of outlets is determined by the design of the placement of actual outlets required for a particular area of a building. A minimum of an additional 20% projected growth capacity should be added to the above outlet quantity calculation.
- ❑ All Division 27 and 28 cabinets will be specified to be the same general products and each contractor will coordinate their cabinets to match those provided by the Structured Cabling contractor.

Structural Cabling

- ❑ Provide, ready for operation, a complete and operational communication network infrastructure system that is a manufacturer certified Category 6 system. The system shall include, but not be limited to, copper and fiber optic cabling, cable protectors, racks, modules, patch panels, faceplates, connectors, hardware, accessories, connections, grounding, and all other material, labor and operations required for a complete operating system in this building.
- ❑ Provide, ready for operation, a complete and operational **wireless access point** communication network infrastructure system that is a manufacturer certified **Category 6a** system. The system shall include, but not be limited to, copper and fiber optic cabling, cable protectors, racks, modules, patch panels, faceplates, connectors, hardware, accessories, connections, grounding, and all other material, labor and operations required for a complete operating system in this building.

- ❑ Patch Cables ER & TR: **Provide Category 6 green patch cords for <u>all</u> patch panel jacks, evenly divided between 3, 5, and 7 foot cords, plus 15% spare of each length.** Cables shall be bootless and the same manufacture as that of the patch panels. Patch cables are to be installed by communications contactor (coordinate with NHCS).

- Patch Cables ER & TR: **Provide Category 6a yellow patch cords for the wireless access point communication network for all patch panel jacks, evenly divided between 3, 5 and 7 foot cords, plus 15% spare of each length.** Cables shall be bootless and the same manufacture as that of the patch panels. Patch cables are to be installed by communications contactor (coordinate with NHCS).
- Contractor and authorized subcontractors will use certified technicians for all cable terminations. Use of temporary or uncertified technicians shall not be permitted. Copies of certifications from the manufacturer are required with shop drawing submittals.
- Cabling vendors must permanently employ at least one RCDD (Registered Communications Distribution Designer). Use of a temporary employee or subcontractor employee for the sole purpose of meeting this requirement shall not be permitted. A copy of the certification is required with the shop drawing submittals.
- Acceptable manufacturers are Hubbell, CommScope, and Panduit.

Riser Cabling

- Riser cables. The riser (backbone) cabling from the ER to each TR in the building consists of multi-pair UTP cables for distribution of voice (telephone) lines, single-mode fiber optic cables for data network distribution, and a ground wire.
- A 12 strand single-mode fiber optic cable shall be installed in each TR.
- If needed, Voice riser sizing. The owner of a new or completely renovated building should estimate the maximum number of telephone lines which are projected to be cross-connected at each TC including a margin for routine growth.
- Physical topology. The voice riser cables, if needed, and fiber optic riser cables will be installed in a star topology originating at the ER.
- Fire rating/pathway. The riser cabling system will consist of appropriately jacketed cables installed in a pathway system interlinking the ER and TRs.

Horizontal Cabling

- Station cables. The horizontal (station) cabling from the ER/TR to the outlet (faceplate) in each work area in the building consists of a bundle of 2 or 4 cables, green or blue in color and installed via the pathway system. This guideline describes the installation and termination of this cabling.

Outlets

- Outlets. The typical outlet to be installed for almost all workspace locations will be a modular faceplate using front loaded adapters and inserts green in color. These outlets are suited for offices, classrooms, computer labs, and auxiliary spaces. They will be equipped with the appropriate number of Category 6 cables.
- Wall VoIP telephone outlets. Finally, some locations will require only a telephone connection. These typically are utility locations, but also include locations where courtesy public telephones are needed. The outlets, green in color, installed in these locations are equipped with one Category 6 cable.

- ❑ Access Point Outlets. The typical outlet to be installed for almost all locations will be a one port surface mount box (biscuit jack). They will be equipped with the appropriate number of Category 6a cables.
- ❑ Outlet selection. The designer of a new or completely renovated building system should determine from the occupants of the workspaces the type of connections they will require. As needed, the designer should coordinate with the owner to determine the best type of outlet to meet the needs of specific occupant spaces.
- ❑ Blanks. Provide blanks for all unused portions of the faceplate.
- ❑ Outlet Patch Cables: **Provide one green Category 6 patch cord for all telecommunications inserts/jacks throughout the facility, evenly divided into 7, 10 and 15 foot cords, plus 15% spare of each length**. Cables shall be of the same manufacture as that of the patch panels. All patch cords supplied shall be from an approved manufacturer. Outlet patch cables will be installed by NHCS.
- ❑ Access Point Outlet Patch Cables: **Provide one yellow Category 6a patch cord for all access point jacks of appropriate length to ensure proper connectivity to the access point**. Cables shall be of the same manufacture as that of the patch panels. All patch cords supplied shall be from an approved manufacturer. Access Point Outlet patch cables will be installed by contractor.

27 05 00 Common Work Results for Communications

NOTE: Specific sections herein relate to portions of the overall project scope of work as performed by the DIVISION 26 – ELECTRICAL designer and contractor but are utilized by the DIVISION 27 – COMMUNICATIONS designer and contractors. Where designated, it is the responsibility of the Electrical Designer to adhere to the design requirements herein and enforce those conditions with the Electrical Contractor. The Sections which apply to this requirement will be designated with the phrase (DIV 26 Scope of Work) in parentheses.

27 05 01 NHCS References and Closeout Requirements

- ❑ Design consultants should refer to the "Agreement for design Consultant Services" between NHCS and the Design Consultant, Exhibit D – Scope of Services, for specific engineering design submittal requirements
- ❑ **NOTE:** Reference Design Guidelines Division 01 for information pertaining to closeout requirements, O&M Manuals, demonstration and training.
- ❑ The Contractor shall submit to the Owner three copies of an operating manual for the systems that have been installed. Each manual will contain the following information:
    - o Warranty and service call information, including any forms needed for notification.
    - o Project Record Drawings. One manual will contain an electronic copy on CD-ROM (AutoCad format).
    - o Where applicable, manufacturer operation manuals.
    - o Where applicable, single line diagrams showing levels throughout the system and impedances.
    - o Copies of Training materials.
    - o Copies of Training videos
    - o Verification and Acceptance Test Reports. Each set of hard copy test results will contain an electronic copy of the test data on CD-ROM. Include any special vendor software necessary to view the test results.
- ❑ Where applicable provide three sets of maintenance data.
- ❑ Provide three sets of Project Record drawings (Project drawing submittals) which have been updated from the submittal process to document the actual project conditions upon Final Closeout.

27 05 10 Abbreviations and Acronyms for Division 27

- ❑ AES – Audio Engineering Society
- ❑ BICSI – Building Industry Consulting Service International
- ❑ ITSIM – Information Transport Systems Installation Manual
- ❑ NAB – National Association of Broadcasters
- ❑ NEC – National Electrical Code
- ❑ NFPA – National Fire Protection Association
- ❑ TDMM – Telecommunications Distribution Methods Manual

27 05 11 Reference Standards for Division 27

- ❑ All Division 27 10 00 – Structured Cabling work will conform to the requirements of the BICSI, 2021 TDMM 14th Edition including TIA-568.2-D and TIA-569 standards and all addenda.

- ❑ All Divisions 27 40 00 – Audio-Video Communications, 27 50 00 Distributed Communications and Monitoring Systems, work will conform to the following reference standards:
    - AES – Handbook for Sound Engineers
    - Sound System Engineering – Davis – Howard Sams 1987
    - The New Audio Cyclopedia
    - NAB Engineers Handbook
    - Manufacturer's recommendations and best practices

Contractor Quality Control

- ❑ Contractor shall perform this work in accordance with acknowledged industry and professional standards and practices, and the procedures specified herein. Furnish and install all materials, devices, components, and equipment for complete, operational systems.
- ❑ Contractor shall maintain a competent supervisor and supporting technical personnel, acceptable to the Owner or Owner's Agent, during the entire installation. Change of the supervisor during the project will not be acceptable without prior written approval from the Owner or Owner's Agent.
- ❑ Contractor shall coordinate all efforts with those of related trades. In the event of any conflicts, delayed or improper preparatory work by others, notify the Owner or Owner's Agent; the Owner or Owner's Agent's decision will be binding. Verify all field conditions.

27 05 26 Grounding and Bonding for Communications Systems (DIV 26 Scope of Work)

GROUNDING.

- ❑ In order to protect personnel and equipment from hazardous voltages and reduce electromagnetic interference (EMI), a proper bonding and grounding system is required for the telecommunications infrastructure in NHCS buildings. The designer should specify this system within the project design for new or completely renovated buildings. This system should comply with appropriate codes, industry standards, and these guidelines.
- ❑ Grounding conductors should be installed neatly, with as few bends as possible, and routed such as to minimize the length of the conductor runs.
- ❑ The grounding conductors may be wall mounted or fastened to ladder racks with plastic cable ties. While they may be routed adjacent to telecommunications cables, they should not be attached to them in any way.
- ❑ An acceptable bond between the grounding conductor and painted metal surfaces is required. In these cases, a small area of the paint should be removed by blade or wire brush prior to the attachment of the ground lug. In TRs, this typically applies to the surface of metal wire ways and to the surface of equipment racks.

THE TELECOMMUNICATIONS GROUNDING SYSTEM WITHIN A BUILDING WILL CONSIST OF THE FOLLOWING COMPONENTS:

- ❑ Design and install telecommunications grounding and bonding system per ANSI/TIA/EIA-607 as defined in TDDM 14th Edition.
- ❑ Bonding conductor (BC) for telecommunications. This conductor links the telecommunications grounding system to the main electrical power grounding system for the building. It originates in the ER.
- ❑ Telecommunications main grounding bus bar (TMGB). This bar is located in the ER and serves as the hub for the telecommunications grounding system in the entire building. Bond the TMGB to the BC, TBB, and local building steel.
- ❑ Telecommunications grounding bus bar (TGB). This bar is located in each TR and serves as the hub for the telecommunications grounding system for that room. It shall be a copper bus bar, insulated from its supports, ¼" thick minimum, and 2" high minimum. Bond every TMG to the TBB and local building steel.
- ❑ Telecommunications bonding backbone (TBB). This conductor links the TGB in each TR back to the TMGB.

THE GROUNDING SYSTEM WITHIN EACH TR SHOULD BE INSTALLED AS FOLLOWS

- ❑ TGB. One telecommunications grounding busbar should be installed onto the plywood on the wall of each TR. It should be installed at 24" AFF. The bar should be electrically insulated from its mounting bracket.
- ❑ TBB. One insulated, stranded, #6 copper wire should be installed from the TGB in the TR to the TMGB in the ER. This conductor should be routed inside the riser conduit system along-side the telecommunications riser cables. It should be fastened to the TGB.
- ❑ Multiple TRs. Stacked TRs may be connected by TBBs in series. A TBB would be installed from the ER to the first TR, a second TBB from the first TR to the second TR, and continued in a daisy chain fashion to the end of the TR stack.
- ❑ Equipment racks. A #6 grounding conductor should be installed between one equipment rack and the TGB using the appropriate grounding lug. The remaining equipment racks should be connected together in series to the first rack to provide a continuous connection to all racks.
- ❑ Ladder racks. A #6 grounding conductor should be installed between one section of overhead ladder rack to the TGB or to one of the equipment racks.
- ❑ Pathway components. A #6 grounding conductor should be installed from each distinct wireway or conduit (over 1" in diameter) which exits the ER and houses either horizontal or riser cabling back to the TGB, ladder rack, or equipment rack. As needed, these components may be connected in series to provide a continuous connection to all components. Grounding lugs should be used to connect the conductor to wireways. Grounding bushings should be installed on conduit ends to connect these conduits to the conductor.

27 05 28 Pathways for Communications Systems (DIV 26 Scope of Work)

ER/TR ELECTRICAL REQUIREMENTS

- ❑ Lighting requirements. Fluorescent lighting fixtures should be installed in each ER/TR to provide a minimum of 50 foot-candles measured 3 ft. AFF. Typically, one pendant mounted fluorescent light fixture should be installed between the front of the row of equipment racks and the wall, and one between the rear of the row of equipment racks and the wall. For

rooms with more than three equipment racks, additional fixtures will be needed.

- ❑ The designer should denote the exact location of fixtures on the drawings to ensure that they do not interfere with or are interfered by the cable ladder racks. Fixtures should not be installed directly above these ladder racks, but instead in spaces between the ladder racks to provide maximum lighting coverage for the room. Since the ladder racks usually are installed directly adjacent walls, the lighting fixtures are usually located 12" from the walls. Finally, the fixtures should be located between 8'-6" and 10'- 0" AFF. In some locations, an additional wall mounted fixture may be necessary. These should be installed so that the top of the fixture is below 6'- 6" AFF since cable ladder racks are installed at 7'- 0" AFF.
- ❑ The typical pendant mounted fixtures are four lamp, 2' X 4' fixtures with acrylic prismatic lens, equipped with electronic ballast and T-8 bulbs. The typical wall mounted fixtures are two-tube fixtures with acrylic prismatic lens, equipped with electronic ballast and T-8 bulbs. All of the fixtures in a room should be controlled from a single pole switch located just inside the door of the room.
- ❑ Power requirements. One duplex receptacle each should be located at 8' intervals on each wall of the ER/TR except the wall containing the door. The receptacles should be NEMA specification grade, 20A, 125V, 3 wire grounding, Leviton, Inc. mfg. part number 5362-I, or equal with steel cover plate.
- ❑ Additionally, each ER/TR should be provisioned with 20A branch circuits located in junction boxes above the ceiling level of each room. Quantity of circuits will be determined by the Technology Consultant and the Electrical consultant. The Electrical contractor will be responsible to connect those circuits to cabinets provided by the Division 27 and 28 contractors.
- ❑ ER outlets consist of: (2)6L-20p, (1) L14-30p, at least 2 double duplex 20 amp standard outlets, all attached to rack(s). Coordinate with the owner on placement locations.
- ❑ TR outlets consist of: (4)6L-20p, at least 1 double duplex 20amp standard outlet, all attached to rack(s). Coordinate with the owner on placement locations.
- ❑ Emergency power. ER/TR are not required to be connected to a generator based emergency power system.

ER ELECTRICAL COMMUNICATION PATHWAYS

- ❑ ER/TR penetrations. Wireways shall transition to EMT sleeves of appropriate size when entering ER/TR. Penetration into ER/TR horizontally will be at 7'- 6" AFF minimum. The ideal penetration height for wireways is 8'-6" AFF. Each sleeve should be stubbed into the room approximately 4" and turned down with a single 45 degree bend. This provides a smooth path to protect cabling and allows smooth flow of cables onto ladder racks (installed at 7'- 0" AFF). If installation of this elbow is not practical, Sleeves serving floors below should be stubbed into the ER 12" AFF. Sleeves serving floors above should penetrate the ceiling of the ER and terminate vertically at 8'-6" AFF.

INTERIOR COMMUNICATION PATHWAYS

- ❑ Horizontal pathway system. A pathway system will be installed in buildings to route and protect all horizontal telecommunications cabling from the ER/TR to the outlets in all workspace locations.
- ❑ Riser pathway system. A pathway system will also be installed in buildings to route and

protect all riser telecommunications cabling linking the ER with all TRs in the building. This system will be installed between ER/TR whether they are vertically stacked or not.

- ❑ Both systems. Although a variety of materials may be used based on site conditions encountered, typically the horizontal pathway system will consist of a network of wire ways and conduits installed in the ceiling areas of the building.
- ❑ Aesthetics. Generally, all visible elements of the pathway system should be painted to match surrounding surfaces. Elements installed in locations not visible by building occupants do not require painting. Typically, these include wire ways and conduits installed above acoustic tile ceilings or in mechanical rooms. Ideally, all elements of the pathway system except for the actual outlet boxes in work spaces will be completely hidden from view. However, in many retrofit projects, this is not possible. In these cases, the designer should carefully determine routing, components used, and supporting methods to minimize the negative aesthetic impact that the installation of the pathway system will have on a building.
- ❑ In some instances, false columns, soffits, and archways have been constructed to conceal wireways and conduits in especially sensitive areas of buildings. These structures should be installed in a manner consistent with the visual architecture of the building, while still allowing access for installation of cabling.
- ❑ Fire safety considerations. The installation of the pathway system shall comply will all applicable fire safety and electrical codes. In general, the N.C. Dept. of Insurance determines the compliance of these systems with codes, and they reserve the right to inspect and approve/disapprove their installation. All wireway and conduit penetrations of rated walls and floors shall be firestopped per applicable UL assembly.
- ❑ Horizontal pathway sizing. The designer should determine the capacity required for each separate section of the horizontal pathway system, and specify these on the drawings. All horizontal cabling is run in a star topology (homerun) from each outlet back to the nearest TR. Therefore, the required capacity of the system increases as it gets closer to the TR. The capacity requirements are smallest at the farthest instances from the TR. **The area should be increased an additional 25% for anticipated growth.**
- ❑ Support mechanisms. A variety of structures may be used to provide mechanical support for the pathway system components. Usually, these are trapeze structures supported from the deck above or wall mounted "L" brackets. The design of the support mechanisms should be based on the structural and architectural composition of the surrounding building structures. In certain locations, aesthetics concerns and limited available space may impact the support systems selected.
- ❑ Cable Tray Wireways:
  - o Trapeze (Ladder Tray only). These structures consist of 1 ½" steel channel installed below and fastened to the wireway and supported with two 3/8" threaded rods run vertically from the channel to the deck or support beams above. One threaded rod is run on each side of the wireway.
  - o When all-thread is used as a support for wireways, smooth rigid tubing will be installed to a minimum of twelve inches above the tray.
  - o Cable trays will have minimum 1" W x 4" D support stringers with 12" spacing.
  - o Wireways shall be supported at intervals not exceeding 5'. Wireways will be supported within 18" of 90 degree turns.

- ❑ Wireways that are not cable trays
  - o Wall brackets. These are "L" brackets fastened to the bottom of the wireway and to an adjacent wall.

Design Parameters

- ❑ Topologies. The horizontal pathway system will consist of a series of wireways radiating from each ER/TR. Larger wireways will be installed from the ER/TR to provide access to all general areas of its geographic zone. Smaller, lateral wireways will branch off as necessary from the larger wireways to extend the pathway system to all occupied areas of the building.
- ❑ The riser pathway system will usually consist of a series of ladder racks in the ER connected to 4" conduits sleeves to cable trays extending to all of the TRs. The design of the system is based on the geographic location of the ER and TRs. Ideally, all of the TRs will be stacked vertically directly above the ER. In this scenario, conduits will be installed through the ceiling of the ER, and stubbed up through the floor of the first TR. Additional conduits would be installed through the ceiling of the first TR, and stubbed up through the floor of the second TR. This pattern would be repeated until the last TR was reached. However, in most buildings it is not feasible to have such a single stack layout. In these cases, the designer should specify routes to interlink the TR to all TRs in the most efficient manner possible, requiring the least amount of cable tray to be installed. In situations where riser conduits can be used between TRs on different floors, the conduits should not be installed through intermediate TRs. All conduits should be stubbed into and terminated in each TR. The cables that are destined for TRs farther along the stack will merely be routed through the intermediate TR using ladder rack or cable management rings.
- ❑ All conduit used as a wireway is to have pull strings installed for future use.
- ❑ Conduit requirements. All conduit should be installed neatly, maintaining the appropriate bend radius for the size of conduit used. The length of flexible conduit installed in the ceiling area should be minimized. Flex conduit should be transitioned to EMT immediately after it exits the hollow wall with the flex conduit supported at its exit from the wall. Conduits should be installed with appropriate offsets (box kicks) where they are connected to outlet boxes and junction boxes to keep surface mounted conduits flush against walls and decks.
- ❑ A maximum of 180 degrees between pull points should be maintained in all conduit runs. This does not include the box kicks described above. No LB-type (or similar) condulets shall be used.
- ❑ No conduit or wireway shall lie directly on top of an acoustic tile ceiling grid or be supported by the grid or the grid supports.
- ❑ No conduit or wireway shall be supported by the same system used to support any other conduits, piping, ceiling structures, ductwork, or other building system or equipment. No non-telecommunications system components should ever be supported by the telecommunications pathway support system.
- ❑ For horizontal pathway system conduits, use junction boxes to create pull points. These should be placed in straight sections of conduits where possible, but may be used to replace conduit bends where bends are impractical. When junction boxes are used in lieu of bends, the conduits should be connected to the junction box with maximum separation to allow the maximum cable radius within the box as possible.
- ❑ Maximum horizontal pathway length. Modern data communications technologies require

that the maximum length of the horizontal cable channel is limited to 295 ft. (90m). Since this channel includes patch cords at the outlet and in the TR/ER and also the cable slack loop installed in the TR/ER, the actual length of the horizontal pathway is somewhat shorter. A good rule of thumb to use in designing these pathways is the "250 ft. rule". The pathway run from the outlet box farthest from an TR/ER back to where the wireway penetrates the wall of that ER should not exceed 250 ft. It is imperative that this calculation includes allowances for the vertical conduit run from the wireway to the outlet box and for the vertical and horizontal deviations in the wireway routing which are common in construction projects.

- ❑ Routing. Typically, wireways are routed in corridors or other publicly accessible areas of the building. Normally, they are routed in the ceiling areas, above acoustic tile ceilings when available. Routing of wireways through occupied spaces is discouraged. This is to prevent disruption caused when an additional outlet is installed after occupancy. In certain cases, however, there is no choice but to route wireways through occupied spaces. As much as possible, this should be limited to lateral wireways farthest from the TR where the disruptive impact is less due to fewer occupants being further "down the line". Individual 1" conduit runs to outlets may be run wherever feasible. For aesthetics purposes, surface mounted conduits should be routed in less visible spaces (closets, storage rooms, etc.) when possible.
- ❑ The wireways should be installed to maximize accessibility for future cable and conduit installations. A minimum of 24" accessible work space should be maintained to the sides of the cable tray.
- ❑ All telecommunications junction boxes should remain accessible. Likewise, wireways and conduits should be installed so as not to block access to other building system components. Some of the access requirements are addressed by codes (electrical junction box covers, breaker panels, exit signs, fire alarm horns and strobes, etc.). Access requirements for other components, while not specifically addressed by codes, should be determined by "common sense" evaluation of system function and ergonomics. These components include water valves, light fixtures, drain clean-outs, HVAC damper controls, and other similar items.
- ❑ EMI sources. Wireways and conduits should be located away from sources of electromagnetic interference (EMI). While the bonded and grounded wireway and conduit system will eliminate considerable EMI effects, it is still prudent to route these components away from potential sources. Potential sources include electrical transformers, large motors, lighting ballasts, etc.
- ❑ Access. In areas of buildings where acoustic tile ceilings are present, the wireway system is typically installed between the top of the grid and the deck above. In these applications, the bottom of the support structure (trapeze) should be installed at least 3" above the grid, independent from ceiling grid. In areas without acoustic tile ceilings, the wireway system should be installed exposed with the bottom of the support structure at least 8'-6" AFF. Wireways should not be installed above inaccessible (hard) ceilings.

- ❑ Perimeter wireway systems. In certain locations (usually labs with large numbers of outlets) non-metallic perimeter wireway systems may be used. The system will be Wiremold V5000 series or equal wireway system. This can be mounted horizontally at any height needed (above 12" AFF) with faceplates installed directly onto the front of the wireway (using a device plate). The wireway can also be installed vertically to create power pole units described above, again with faceplates installed directly onto the front of the wireway (with device brackets). The system can be painted as needed to match surroundings.
- ❑ Outlet location. Typically, all outlets are installed at 18" AFF. For aesthetics purposes in new construction, the bottom of the outlet box should be installed even with the bottom of electrical receptacle boxes. Outlet boxes may be mounted higher if necessary to be located above furniture, counter tops, or equipment.
- ❑ **Wireless access points shall be installed by the cabling contractor.**
- ❑ Outlet boxes should not be located too close to wet areas such as sinks where water could splash onto faceplates or where patch cords could come into contact with water. Boxes also should not be located too close to sources of excessive heat, dust, chemicals, or EMI.
- ❑ Outlet boxes should also be located so that they will be accessible to technicians for patch cord installation or for faceplate re-termination even after furniture and equipment is installed. A balance should be maintained between "hiding" outlets for aesthetics purposes and keeping the faceplates accessible. Boxes should not be installed behind heavy equipment or modular furniture panels.
- ❑ Ergonomics and egress factors should be considered when planning outlet locations. Outlets should be located so as not to require telephone or data patch cords to be installed across doorways, aisles, or other "people" traffic areas.
- ❑ Outlet box type. The outlet box type is determined by the type of wall construction present where the outlet is to be installed.
- ❑ Flush mounted outlet boxes should be installed in all walls of drywall and standard stud (2 ½" -3 5/8" deep) construction. In some retrofit projects, the presence of cross members (purlins) in the walls may complicate or even prohibit the installation of flush mounted outlet boxes. The top and bottom flanges (ears) of old work boxes should be adjusted so that the box itself does not protrude at all beyond the surface of the drywall. In general, flush mounted outlet boxes should be installed exactly straight (perpendicular to walls and floor) and flush with the surface of the drywall (after plaster ring installation). No gaps between the edge of the faceplate and the drywall should be present after final installation. Conduit to be installed so as to come into the top of the box, into one of the back knockouts.
- ❑ Surface mounted outlets should be installed onto all other wall types (masonry, plaster, prefabricated wall panels, etc.). In cases where a surface mounted outlet is required use Wiremold 2300 or equivalent raceway. The raceway and box may or may not be painted to match the surrounding wall surface. For cleanest appearance, a bead of latex caulk may be applied between the wall and each side of the raceway. In these cases, the raceway and box should be painted.
- ❑ Outlet quantities. Since the cost of the telecommunications infrastructure of a building is directly proportional to the number of outlets installed, careful planning of outlet quantities and locations is essential. While each project is unique, the following guidelines may assist in determining outlet quantities:
    - Offices. Typically, a single occupancy office is equipped with two

telecommunications jacks. Due to the ergonomic and egress issues addressed above, some offices may require a second faceplate containing the necessary jacks. Normally, the primary outlet is located near the corner of the room farthest from the door. While outlet locations may be specified to coincide with the furniture layout of a room, it should be noted that the occupant and the furniture layout of an office is likely to change several times over the life of the telecommunications infrastructure. Usually, it makes better sense to locate the outlet to fit the space, not necessarily the current occupant's furniture layout.

- Classrooms – A typical classroom will be equipped with Category 6 jacks. Coordinate with the owner for specific jack counts.
- Conference rooms. Usually, four Category 6 jacks are installed in each conference room, two at each end of the room. This is to allow maximum flexibility in the arrangement of the room for particular presentations.
- CTE labs. These are rooms where desktop computers are permanently located in the room (as opposed to classrooms where students bring in laptop computers for one class session at a time). Design of outlets for these student computer labs requires careful coordination with the furniture and computer equipment layouts of the room. Typically, one faceplate is installed in the room at the "instructor" station. The remaining lab computers are served by faceplates where all jacks are used for computer connections. The room should be provisioned so that each computer is served by its own jack. Usually, the necessary jacks are installed on a wall to serve each contiguous group of desks. Jacks should be located so that patch cords will not be required to be installed across doorways or aisles between desks. For groups of desks which cannot be located adjacent to a wall, a power pole with jacks attached should be installed to each group. Using a section of Wiremold V5000 mounted vertically from floor to ceiling with faceplates mounted onto the cover is the desired methodology.
- Other instructional spaces. Locating jacks in these rooms requires a case-by-case design with input from the personnel who will be inhabiting each particular space. In general, a jack should be installed in each office-type work space where a telephone and/or computer is likely to be located. In addition, jacks should be installed where equipment or monitoring devices are to be installed which need access to the data network.
- Auxiliary spaces. An additional jack is required for many building spaces not addressed above. These include: the main mechanical room in each building (for connection of energy monitor controller equipment), copy machine areas, and main janitorial rooms which serve as office space for custodial staff, etc.
- Cafeterias will typically require data at the serving line, office, and the location designated for an external ringer.
- **Mobile classrooms/structures shall use a cable rated for wet locations.**

Support Structures

- ❑ The structures installed to support the pathway systems must be adequate to support the weight of the pathway components, the weight of the cables, and the force exerted on the pathway system during cable pulling operations. The support system must be adequately anchored into the surrounding building structure. A variety of support structure components

may be used as dictated by site specific conditions. However, all components shall be supported per NEC codes or per these guidelines, whichever is stricter

Anchoring

- ❑ Suitable anchoring methods must be utilized to fasten pathway support components to the building's structure. These must be matched to the various structural and architectural elements found in NHCS buildings. Careful research may be required by the designer to determine the existing conditions of buildings. Since these buildings were constructed over a multiple year timeframe, existing structures vary widely in type of construction and in quality (due to deterioration). Following are some general guidelines regarding anchor installation:
  - Masonry walls, decks, and beams. Masonry structures provide perhaps the ideal system for anchor installation. This system involves installing appropriate metal anchors into solid concrete decks or beams or into masonry walls. These anchors may be installed by drilling or by use of powder actuated tools.
  - Steel beams and trusses. Threaded rods installed vertically up to beam clamps that are fastened to overhead steel structural elements are an acceptable anchoring practice.
  - Stud walls. Normally, wireways and riser conduits are not supported from drywall/plaster and stud construction walls. However, if no overhead support is possible, "L" brackets may be fastened securely to the wall studs. Brackets should not be fastened to the wall surface material only.
  - Hard ceilings. Ceilings that are not suspended acoustic tile (drywall, tongue and groove tile, spline type, etc.) shall not be used to support wireways or riser conduits. Threaded rods may pass through ceilings of this type to reach structural elements above. If these ceilings form part of a fire rated barrier, they must be completely restored to maintain the originally designed rating.
  - Outlet conduits. 1" conduits run between wireways and outlet boxes may be fastened to a variety of surfaces using one-hole straps and anchors. The anchors must be suitable for the material to which they are fastened. These straps may be fastened to concrete decks and beams, masonry walls, or surfaces of gypboard/plaster ceilings and walls. They also may be fastened to steel beams and trusses using beam clamps and threaded rod. They may not be attached to ceiling tiles or grids of any type, including acoustic tile, tongue and groove, spline type, etc…
  - Toggle bolts. In general, toggle bolts should not be used for support of any pathway component larger than a 1" conduit.

Firestopping

- ❑ All locations where wireways or conduits penetrate rated walls or floors shall be fire stopped per the applicable UL assembly. The designer shall be responsible for inclusion of the proper assemblies in the design drawings.
- ❑ At locations where wireways penetrate rated walls or floors, conduit sleeves (18" long) should be used through the penetration. Proper fire stopping should be installed around the penetrated sections. Also, the conduit shall be fastened securely to the wall or floor to prevent future invalidation of the fire stopping by vibration or movement of the section with respect to the wall or floor. Comply with UL assemblies designated for fire stopping around EMT conduits.

Installation Checklist

- ❑ The standard checklist below has been developed to govern the installation of the various pathway system components commonly installed. Some of the items are described above in greater detail. These items should be included in the designer's inspection prior to the final acceptance of the system. This list is to be used as a guide only. It is not intended as a substitute for the drawings, specifications, applicable codes, or good work practices.

- ❑ Surface outlets.
  - Is the outlet box level?
  - Is the outlet box painted to match the wall (if required)?
  - Are proper conduit offsets (box kick) installed?
  - Are all junction box covers screwed shut?
  - Is a pull string installed with a minimum 12" at each end?
  - Are penetrations of rated walls firestopped properly?
  - Is the firestopping installed on both sides of the wall?
  - Does it meet the appropriate UL assembly requirements?
  - Is the annular space around the conduit within UL limits?
  - Are visible penetrations of all walls patched and painted properly?
  - Are plastic bushings installed on telecommunication conduits?
- ❑ Flush outlets.
  - Is the outlet level?
  - Is the outlet flush with the wall surface?
  - Are the box ears or plaster ring adjusted to recess the box into the wall?
  - Are the center (device screw hole) tabs cut into drywall?
  - Is the outlet secure, with jiffy clips tight?
  - Is the locknut secure?
  - Are all junction box covers screwed shut?
  - Is a pull string installed with a minimum 12" at each end?
  - Is the flex penetration hole patched?
  - Is the flex securely strapped as it exits the hollow wall?
  - Is the flex to EMT connection installed properly?
  - Is the conduit strapped or supported every 5'?
  - Are junction boxes located between every 180 degrees of conduit bends?
  - Are penetrations of rated walls firestopped properly?
  - Is the fire stopping installed on both sides of the wall?
  - Does it meet the appropriate UL assembly requirements?
  - Is the annular space around the conduit within UL limits?
  - Are visible penetrations of all walls patched and painted properly?
  - Are plastic bushings installed on telecommunication conduits?
- ❑ Wireway.
  - Are all cuts deburred?
  - At rated wall and floor penetrations, have necessary conduits been installed to support the wireway penetration?
  - Are penetrations of rated walls and floors firestopped properly?
  - Is the firestopping installed on both sides of the wall/floor?

- Does it meet the appropriate UL assembly requirements?
- Is the annular space surrounding the wireway sleeve within UL limits?
- Are wireway penetrations into TRs turned down with a single 45 degree elbow?

❑ Riser conduits.
- Are wireway section pull points installed between every 180 degrees of conduit bends?
- Are penetrations of rated walls firestopped properly?
- Is the firestopping installed on both sides of the wall?
- Does it meet the appropriate UL assembly requirements?
- Is the annular space around the conduit within UL limits?
- Are visible penetrations of all walls patched and painted properly?
- Are grounding bushings installed on all conduit ends in ER/TRs?
- Are plastic bushings installed on conduits larger than 1”?
- Are pull strings installed with a minimum 12” at each end?
- Are vertical runs secured properly to walls?

❑ Trapeze and All-Thread supports.
- Are threaded rods properly secured to anchors?
- Is smooth rigid tubing installed to a minimum of twelve inches above the tray?
- Are anchors properly installed and secured to the building structure?
- Are the trapeze channels level (horizontal)?
- Are threaded rods cut flush and deburred?
- Are supports installed every 5’?
- Are wireways connected securely?
- Are nuts and washers installed both above and below the bracket?

❑ Wall bracket supports.
- Are “L” brackets properly secured to walls?
- Are wireways securely connected to brackets?
- Is proper (3” min.) clearance maintained between wireways and wall?
- Are visible brackets painted to match the surrounding area?

AREAS OF BUILDINGS THAT SHOULD TYPICALLY NOT BE USED FOR WIREWAY OR CONDUIT ROUTING. THESE INCLUDE:

❑ Stairwells.

❑ Elevator shafts and equipment rooms.

❑ Outdoor areas (including covered breezeways) where moisture may be present.
Even areas protected from rain, but subject to dew or other condensation sources should not be used for these pathway systems components.

❑ Wet areas inside buildings such as shower facilities, equipment wash down areas, steam rooms, etc.

❑ Hazardous locations. Since the wireways need to remain accessible for technicians to install cabling on an ongoing basis, routing through areas exposing personnel to dangerous heights, high voltage equipment, hazardous chemicals, etc. should be avoided. Likewise, areas housing equipment or activities that are particularly susceptible to damage by technicians installing new cabling should also be avoided.

- ❑ Locations with excessive heat. The cabling to be installed in these pathway systems is not designed to withstand excessive heat. Wireways and conduits should be routed to avoid heat sources hot enough to cause sheath deformation over time in the cables. These include steam lines, boilers, etc.

(DIV 27 Scope of Work)
CABLE MANAGEMENT

- ❑ Building Locations - Comb straight and form in a neat and orderly manner all conductors in cable support systems, providing circuit and conductor identification. Tie wraps are only to be used for cable management, not support. Arrange as required using tie wraps of appropriate size and type, (plenum rated as required).
- ❑ Equipment Cabinets or Racks - Comb straight and form in a neat and orderly manner all conductors located within equipment cabinets in the head end room or remote locations, and wiring harnesses in the head end room. Tie as required using Velcro cable ties of appropriate type and size.
- ❑ Service Loops - Provide 10 foot service loops at each termination so that plates, panels, and equipment can be dismounted for service and inspection.
- ❑ Supports - All cable installations which are not supported by a cable tray or conduit system methodology as noted for J-Hooks installation.
- ❑ The installation of all education technology cabling, regardless of type and separation requirements, from the head end room to various zones throughout the facility will use common pathway routes.
- ❑ Inaccessible ceiling areas, such as lock-in ceiling tiles, drywall or plaster, will not be used as distribution pathways. Should inaccessible ceiling areas be the only available pathway, the designer will notify the owner immediately for direction.
- ❑ Accessible ceiling areas must have adequate and suitable space available for the distribution layout (minimum of three inches clear vertical space between ceiling tiles and distribution wiring and pathway).
- ❑ The design shall provide a suitable means and method for supporting cables and wires from the head end room (and/or telecommunications closet) to the area being served. The cable will not be laid directly on the ceiling tiles or rail.
- ❑ Cable support will be provided through the use of open-top cable supports located on 48-60 inch centers.
- ❑ Cables from each zone to TR/ER will be grouped and tied.
- ❑ Wiring Harnesses - All wires and cables used in assembling custom panels and equipment racks shall be formed into harnesses, tied with Velcro tie wraps and supported in accordance with accepted engineering practice.
- ❑ Harnessed cables shall be combed straight. Each cable that breaks out from a harness for termination shall be provided with an ample service loop.
- ❑ Harnessed cables shall be formed in either a vertical or horizontal relationship to equipment, controls, components, or terminations.
- ❑ Do not pull wire or cable through any box fitting or enclosure where change of raceway alignment or direction occurs; do not bend conductors to less than recommended radius. Employ temporary guides, sheaves, rollers, and other necessary items to protect cables from excess tension, abrasion, or damaging bending during installation. Care shall be taken not to

bend, crush or kink cables.

- ❑ All cable shall be installed in a complete, neat, and orderly fashion. Cables shall not be twisted or have any damage to the cable jacket.
- ❑ Cables will be installed parallel or at 90 degree angles to the building walls. Diagonal, beeline, or non-supported cable routing is unacceptable

Terminal Blocks

- ❑ All terminal block connections shall be readily accessible. Not more than one wire connected to one terminal. Spare terminal blocks, equivalent to 10% of those in actual use shall be provided.
- ❑ **Terminal blocks shall be 66-Type and be installed on fire rated plywood backboard located in ER**.
- ❑ Splicing - Splicing of cables is not permitted between terminations.
- ❑ Wall and Floor Penetrations - All penetrations through floors and walls will be sleeved. All sleeves will have permanently installed bushings.
- ❑ **Sleeves will be sized to accept 50% growth.**
- ❑ All sleeves will be installed per manufacturer's instructions and will protrude 3 inches on each side of the penetration.
- ❑ Sleeves through floors will be supported with conduit riser clamps.

- ❑ Existing sleeves can be used with the following exceptions:
  - o Use of any sleeve containing emergency signaling cable is prohibited
  - o Using any sleeve, when doing so would exceed 40% fill ratio, is prohibited.

27 05 43 Underground Ducts and Raceways for Communications Systems (DIV 26 Scope of Work)

EXTERIOR COMMUNICATION PATHWAYS

Overview

- ❑ Inter-building communications pathways are classified as either of two basic types:
  - o Building entrance pathways are duct banks which connect an individual building to the above campus backbone pathway system. These guidelines mainly describe design parameters for building entrance duct banks. Design and planning for a campus backbone duct bank system does not really pertain to the types of campuses found in New Hanover County. However, the detailed requirements for entrance duct banks described here typically apply to backbone duct banks as well, just on a larger scale.
  - o Campus backbone pathways comprise a network of underground duct banks and manholes interconnecting Equipment Room (ER) facilities to all areas of the campus.

Pathway Composition

- ❑ The underground pathway system consists of a series of manholes and hand holes connected by concrete encased duct banks. These duct banks include 3" and 4" diameter PVC conduits (for copper cables) and 1 ½" diameter PVC conduits (for fiber optic cables) installed in the same duct bank trench. In remote areas un-encased ducts, direct buried, or aerial pathway systems may be used with approval from the owner.

- New buildings. The design and construction of the building entrance pathway system for a new building should be included in the building project scope. If applicable, contact the owner to determine the location of backbone manholes near a project site.
- Single function. The inter-building communications duct banks and manholes are to be used solely for the telecommunications cables described above. They are not to be shared with electrical cabling, any auxiliary low voltage systems, or any other utility. They shall not be used by other communication service providers. The duct bank trench may be constructed as a joint telecommunications/electrical trench as long as there is a minimum of 4" of concrete separating each telecommunications duct cell from any electrical duct cell. Also, cells from each utility should split at manhole locations so that they are routed to a separate manhole for electrical or for telecommunications connections.

Duct Bank Design

- Sizing. The entrance duct bank for a campus building shall consist of two 4" and four 1 ½" conduits from the nearest telecommunications manhole to the building ER. For single buildings not connected to a campus duct bank, one 4" and two 1 ½" conduits to the utility service point will suffice.
- Construction methodology. Typically, all duct banks will consist of PVC conduits encased in concrete. On occasion, when site considerations dictate, other underground installation methods may be employed. These include boring of metal casings under rail lines or roadways, directional boring, and other similar non-trenching methods. These should only be used when trenching is not feasible.
- Water infiltration. Entrance duct banks should be designed so that water, which may collect in the conduits, will drain away from where the conduits enter the building. Whenever possible, the top of the manhole nearest to the building should be lower than the finished floor of the ER. In addition, the manhole wall should be sealed around the conduit penetrations to prevent excess water infiltration. Finally, the manhole should be placed so as to provide slight positive drainage away from manhole cover after final restoration to grade is completed.
- Duct bank bends. A manhole or hand hole should be installed in duct bank runs for every 180 degrees of conduit bends. The minimum bend radius which is acceptable at any point in the duct bank run (horizontally or vertically) is 3"– 6" for 4" conduits and 9" for 1 ½" conduits. Duct banks should be designed to allow for installation of very long sweep bends accomplished by heating and bending straight conduit sections. When factory elbow fittings are required, the bend radii for such fittings should not be less than those specified above. These fittings shall be electrical or utility elbows. Use of plumbing fittings is not allowed.
- Manhole placement. Manholes or hand holes should be installed at least every 300' in straight duct bank sections and every 150' in duct bank sections with at least 90 degrees of total conduit bends.
- Building penetration. For new buildings, the entrance duct bank should be installed under the building slab and turned up vertically through the floor of the ER. Horizontal penetration into a below grade building area is also acceptable. For duct banks installed into existing buildings, the designer should determine the best method of building penetration based on: the structural aspects of the building slab and footings, exterior of building aesthetics concerns, and existing utility conflicts. When possible, it is preferred to have the duct bank

penetrate underneath the building and turn up inside the building to reach the ER. If this is not possible, the ductbank can be turned up on the outside wall of the building to a large junction box. Conduits would then be installed through the back of the junction box through the exterior wall of the building and on to the ER. LB type (or similar) condulets should not be used in lieu of the above junction box.

- ❑ Routing to the ER. Entrance duct banks which require less than 50' of entrance cable (measured from the point where the duct bank enters the building to the point of cable termination) may be constructed with EMT conduits run inside the building. For runs longer than 50', rigid or intermediate metal conduit and fittings shall be used. The section of conduits installed in the building slab are not to be considered in the length calculations.
- ❑ In either case, conduit turns inside the building should be accomplished by conduit bends, not by installation of pull points at the bend. Pull points should be installed in the entrance conduit runs for every 180 degrees of conduit bends (including bends both inside and outside the building). These pull points should be installed only in straight conduit sections. For EMT conduit runs, these pull points should be constructed by installing junction boxes or straight sections of wireway along the run. For rigid metal conduit runs, they should be constructed by installing "Type C" condulets along the run. LB type (or similar) condulets should not be used.
- ❑ Tree protection. Duct Banks should be routed so as to remain outside of the drip line of existing trees.

Manholes and Handholes

- ❑ Contractor scope. The contractor will provide all materials, labor, and equipment necessary to install new manholes and handholes. All manholes and handholes are to be installed according to manufacturer specifications.
- ❑ Interior hardware. Two cable racks are to be installed securely on the inside of each wall of the manhole or handhole. They are to be evenly spaced horizontally unless prevented by the location of the conduit penetrations. Two cable hooks are to be installed on each cable rack.
- ❑ A manhole ladder is to be installed inside each manhole. It is to be securely fastened with bolts and anchors to the neck (or top) and the bottom of the manhole.

- ❑ Each manhole and handhole is to be equipped with a minimum of four floor mounted pulling irons.

Grounding

- ❑ A grounding rod is to be installed in the bottom of each manhole or handhole, either through a designated ground rod hole or through the sump opening. Each cable rack is to be properly bonded and grounded to the grounding rod in series using a #6 copper ground wire or bonding ribbon using bolted connectors
- ❑ Covers. Heavy duty manhole covers are to be installed for all manholes and hand holes, regardless of the type of pedestrian or vehicular traffic expected in the area. Covers are to be installed flush with the surface of asphalt streets, and with the surface of asphalt, concrete, or brick paver walkways. For non-paved surfaces, the covers are to be installed to ensure that positive water drainage away from the cover occurs. The contractor is to provide all items necessary, whether pre-cast or masonry, to extend the rim and cover above the manhole or hand hole to accomplish the above. All entrance extensions should be sealed to prevent water infiltration. Duct bank conduits shall not be installed into these entrance extensions (necks).

Duct Bank Construction

- ❑ Pre-trenching. Prior to any excavation activity, the contractor shall arrange for an approved utility locator service to locate and mark all public utilities on the project site. The contractor shall also coordinate with the Maintenance Department to locate and mark utilities on the project site.
- ❑ Asphalt and concrete surfaces are to be sawcut along the duct bank route and at manhole and hand hole locations. Removed materials are to be disposed of legally, off site, by the contractor at no expense to the owner.
- ❑ Trenching. The contractor shall follow all OSHA trenching and excavation safety standards. Unsuitable materials are to be disposed of legally, off site, by the contractor at no expense to the owner. These shall be promptly removed from the project site, without significant on-site stockpiling. In all areas where the new duct bank crosses existing utilities of all types, hand excavation will be employed by the contractor.
- ❑ The contractor shall notify the owner immediately if any existing utilities are damaged. Any existing utilities damaged shall be repaired by the contractor (or the owning public utility paid by the contractor) at no additional expense to the owner. Repairs shall be made expeditiously to minimize inconvenience to the owner and with methods and materials of the same or better quality than the existing.
- ❑ Conduit installation. All conduit installed shall be Schedule 40 PVC unless otherwise noted. The 1 ½" conduits will typically consist of prefabricated units of four conduits connected by plastic spacers and arranged in a square pattern (tetra-duct). If necessary, individual 1 ½" conduits may be installed instead.
- ❑ Plastic spacers are to be installed every 5' to maintain minimum separations, vertically and horizontally, between adjacent conduits, and between the conduits and the sides, top, and bottom of the duct bank. The minimum required spacing between conduits is 2 ½" (with the exception of the internal spacing of the conduits within the tetra-duct described above). The minimum required spacing between any conduit and any edge (side, top, or bottom) of the duct bank is 4". The exact configuration (cross-section layout) of the duct cells should be

specified by the designer. However, the contractor may modify this configuration if required by field conditions as long as the spacing and minimum backfill cover requirements are maintained.

- ❑ Contractors must adhere to OSHA confined space entry standards when working within existing manholes.
- ❑ Sections of #4 rebar shall be installed between the bottom of the conduits and the bottom edge of the duct bank. A minimum of 1 ½" of concrete should be maintained between the rebar and the bottom edge of the duct bank. Rebar should be installed longitudinally at 12" O.C. with cross members of #4 rebar installed every 60" O.C.
- ❑ Concrete pouring. The contractor shall have the installed conduits inspected and approved by the owner and/or designer prior to pouring of concrete. 3,000 PSI concrete will be used to encase all duct banks. The concrete should be allowed to set for 24 hours, minimum, prior to backfill.
- ❑ Warning tape. A continuous run of magnetically detectable underground marking tape shall be run directly above the duct bank at 12" below finished grade.
- ❑ Backfill. A minimum of 24" of cover is required above the top of the concrete in each duct bank run. This is measured to the top of final grade, and includes asphalt, concrete sidewalk, brick paver, seeded topsoil, and corresponding subgrade base layers. In roadway and walk-way areas, at contractor discretion, controlled low strength material (CLSM), "flowable fill," may be used to backfill the trench. The contractor shall have the installed concrete encasement inspected and approved by the owner or designer prior to installation of backfill material.
- ❑ Compaction of earth backfill shall be at least 98 – 100% maximum density, using the Modified Proctor Method at all locations. Compaction testing is to be performed by a geo-technical testing firm approved by the owner.
- ❑ Final construction items. Following duct bank installation, all construction debris should be removed from manholes. Also, a mandrel should be pulled through each duct cell in the presence of the owner or designer, and each duct cell cleaned of debris. Finally, a mule tape (high strength, conduit measuring tape of non-deteriorating material, with footage markings) should be installed in each duct cell and secured to cable racks in each manhole or hand hole.

Site Restoration - Asphalt Pavement

- ❑ Scope. All asphalt pavement surfaces cut or damaged by the construction of the duct bank should be restored to pre-project conditions as much as possible. Methods used shall comply with the latest version of the NCDOT – Standard Specifications for Roads and Structures.
- ❑ Sub-grade preparation. The finished subgrade should provide a uniform bearing surface. The sub-grade should remain in satisfactory condition and properly drained until surface courses are placed. Methods used shall be in accordance with the NCDOT Specifications Section 500.
- ❑ Aggregate base course. The aggregate base course (stone) shall comply with the applicable paragraphs of the NCDOT Specifications Section 520. The compacted base shall be a minimum of 6" thick.
- ❑ Bituminous concrete surface course. The spreading, compaction, and finishing of the surface course shall comply with the NCDOT Specifications Sections 610 and 645. The asphalt installed shall be type I-2 at a minimum compacted depth of 2".

- ❑ Tack coat. Application rates, methods of application, and curing shall be in accordance with NCDOT Specifications Section 605. Vertical surfaces shall be coated with AC-20 tack coat prior to paving operations to ensure proper bonding.
- ❑ Pavement markings. All pavement markings disturbed by the duct bank construction shall be replaced to match existing. All work will conform with the NCDOT Specifications Section 920.

Site Restoration – Concrete Sidewalks, Curbs, and Gutters

- ❑ Curb and gutters. Curb and gutter disturbed by the duct bank construction shall be constructed or repaired to match original conditions. Present alignment and grade should be maintained to promote drainage to existing curb inlets. The curb and gutters shall be constructed in accordance with the NCDOT Specifications Section 846.
- ❑ Concrete sidewalks. Concrete sidewalks disturbed by the duct bank construction shall be constructed or repaired to match original conditions. The sidewalks shall be constructed in accordance with the NCDOT Specifications Section 848. In addition, sidewalks should have contraction joints spaced equal to width of the walk. A ½" expansion joint should be placed at all intersections and at locations where the walk abuts structures and other walks. Finally, walks should receive a light broom finish

Site Restoration – Grass Areas

- ❑ Acceptance. The final authority for the acceptance of the restoration work and the practices used for grass areas is the NHCSD Maintenance Department. The contractor shall ensure a uniform stand of specified turf no less than 30 days after germination. Upon final acceptance, Maintenance will assume responsibility for maintenance of the work. Intermediate inspection and acceptance of the work by Maintenance is required at the following milestones:
  - o 1) after installation of the subsoil and topsoil, and
  - o 2) at the removal of the Certified Seed Tag from the seed being placed – witnessed by Maintenance personnel.
- ❑ At the discretion of Maintenance, the contractor may be required to submit a list of proposed materials, together with such samples as may be requested.
- ❑ Subsoil. All areas should be subsoiled to a depth of 6". Subsoils should be used which are closely related to existing soils in the area, and should be compacted to 85% density. Subsoils should not be worked under frozen, muddy, or saturated conditions. Immediately prior to the dumping and spreading of the topsoil, at least the top 2" of the subsoil should be loosened or scarified to permit bonding of the topsoil to the subsoil.
- ❑ Topsoil materials. The contractor should furnish soil which is fertile, friable, natural loam surface soil. Existing topsoil removed during excavation may be used upon approval from Maintenance. New topsoil shall not have more than 20% subsoil, and shall not contain slag, cinders, stones, lumps of soil, sticks, roots, trash, or other extraneous materials larger than 1" in diameter or length. It shall also be free of plants or plant parts of: kudzu, quackgrass, Johnson grass, nutsedge, poison ivy, or other noxious weeds.
- ❑ Topsoil installation. Topsoil should be uniformly distributed to a depth of 4" after firming. The topsoil should be graded to match the surrounding drainage scheme. Upon completion of grading, the area should be cleared of all grade stakes, surface trash, or other objects which would hinder the maintenance of the seeded areas.

- ❑ Seeding materials. Since the exact composition of seed materials is site and season dependent, the type used will be determined by Maintenance on a case by case basis.
- ❑ All seed shall be 95% pure with 85% germination. Seed shall be fresh, clean, new crop seed complying with the tolerance for purity and germination established by the Official Seed Analysis of North America. Wet or moldy seed shall not be used. Seed mulch shall be clean wheat straw.
- ❑ Seeding. Seed should be lightly disked or raked into top 1" of topsoil. Clean wheat straw should be applied as mulch at a rate of 45 lbs./1,000 sq. ft. Emulsified asphalt tack should be installed in sufficient quantities to hold straw in place.
- ❑ Warranty. Any seeding requiring correction shall be reseeded by the contractor up to one year following the completion of the project at no expense to the owner.
- ❑ Site restoration – site equipment.
  - o Fencing. All fencing damaged or removed as part of duct bank construction shall be restored to original conditions.
  - o Misc. equipment. Other on site equipment damaged or relocated during the duct bank construction shall be restored to original conditions, including supports.

Site Protection

- ❑ Cleanliness. Contractors will be required to maintain a clean work site at all times during, and upon completion of, construction. Sites shall remain clear of excess debris, surplus materials, and tools and equipment not in active use. Contractors will be responsible for cleaning campus streets and walks of any debris, dirt, or mud resulting from construction and contractor's vehicle traffic.
- ❑ Catch basins should be protected or covered to eliminate dirt, mud, asphalt, and tack from entering them. Any materials which do enter catch basins shall be cleaned out by the contractor at no expense to the owner.
- ❑ Vehicle traffic. Contractors shall be responsible to coordinate all closings of parking lots and streets with the owner. Contractors will be required to make arrangements for closings at least two full working days prior to closure. Contractors shall maintain continuous, safe vehicular traffic flow through and adjacent to the project site. This includes, but is not limited to, use of flagmen, signage, barricades, cones, and lighting. Contractors will be responsible to provide all such equipment and will not be allowed to use district equipment for such purposes.
- ❑ Areas where sawcut asphalt has been removed may not be left open for vehicle traffic unless backfilled with stone or flowable fill. Warning signs will be required to alert traffic of uneven surfaces.
- ❑ Pedestrian traffic and safety. Contractors shall be responsible for ensuring that all sites are properly equipped with warning and barricade equipment at all times. Detours for pedestrian walkways are to be properly planned with considerations given to handicapped access. They are to be approved by the owner, and clearly marked and barricaded. No handmade signs will be allowed.
- ❑ Tree protection. Contractors will not stockpile debris or surplus materials, or park vehicles or equipment under trees. Care should be taken to ensure tree limbs are not damaged by vehicles or equipment. No excavation of any kind should be performed under the drip line of trees. No trees or shrubs may be removed without prior owner approval.

27 05 53 Identification for Communications Systems

- Manufacturers Identification - Each major component of equipment shall have the manufacturer's name, address, model number, and rating on a plate securely affixed in a conspicuous place. NEMA code ratings, UL label, or other data which is die stamped into the surface of the equipment shall be stamped in a location easily visible.
- Custom Panel Identification and Nomenclature - Switches, connectors, jacks, receptacles, outlets, cables and cable terminations shall be logically and permanently marked in a manner approved by the Owner. Custom panel nomenclature shall be engraved, etched, or screened. Marking for these items are purposely detailed in the drawings to ensure consistency and clarity. Verify any changes in working type size, and/or placement with the owner prior to marking. Mount on the custom rack panels as described above a designation of each source machine, which correlates to the system architecture. Submit a sample layout for Architect approval.
- Terminal Blocks and Rack Mounted Equipment Identification - All terminal blocks, rack mounted equipment, and active slots of card frame systems shall be clearly and logically labeled in a manner acceptable to the owner as to their function, circuit, or system as appropriate. Labeling on manufactured equipment shall be engraved plastic laminate with white lettering on black background or dark background. Handwritten identification is not permitted. The contractor may substitute metallized polyester permanent identification labels with black printing on silver, white, or another light color background for the phenolic labels above.
- Cable Identification - All cable terminations shall be clearly and permanently labeled with appropriate cable number. Labeling of termination systems shall be provided on white labels with black typed lettering. Handwritten labels shall not be permitted. Provide a sample of labeling material and example of the numbering scheme planned for use at the facility with project submittals. The contractor will endeavor to utilize the environmental room number the facility administrators plan to use for new construction projects. If environmental room numbers are not available, the contractor will utilize the most recent set of architectural floor plan room numbers for the cable numbers. Once the contractor has utilized a set of room numbers, those numbers and floor plans showing those numbers must be used for all documentation purposes from that point forward for the project unless changes are approved in writing by the Owner's Agent.
- For jacks installed above the ceiling grid for use with wireless access points, door access controls, etc. a permanent label with appropriate cable number shall be placed on the ceiling tile grid in as close proximity as possible to the terminated jack. The label shall be yellow with black typed lettering. Handwritten labels shall not be permitted.
- Wall plates shall have the ER/TR # and Room # identified across the top of the plate.
- The intent of this labeling scheme is to assist in troubleshooting cable problems. Therefore, the cables are labeled in a manner that will direct the technician to the opposite end of the cable to allow for testing and troubleshooting.
- All fiber backbone cables will be labeled with a unique identifier at each end and at junction / pull boxes. Fiber backbone cables will be labeled 12" from each end of the cable with a destination tag that identifies each cable's remote destination and the *unique identifier* to be determined and approved by the owner.

- ❑ All telecommunication outlet (TO) cables are to be labeled within 12" of each end of the cable using the above described identifier. TO numbers in each room are determined by numerical sequence starting from the main doorway of each room and continuing in a clockwise manner around the room. Each faceplate containing data ports will be labeled starting in the upper left hand corner of each 1 gang section and assigned in a left to right and top to bottom direction.
- ❑ Patch Panel- ports are to be labeled using the *unique identifier* to be determined by the owner.
  - o Telecommunication Outlets (TO) that are serviced by a patch panel will be labeled using the *unique identifier* to be determined by the owner.
- ❑ All test report documentation will contain a complete circuit id based on the applicable labeling scheme.

27 06 00 Schedules for Communications

NOTE: It is the intent of the revised specifications to have "schedules" of technology ports and components similar to "door schedules" for architectural sections. See Attached Example "Room Matrix Definitions" and "Room Matrix"

27 08 00 Commissioning of Communications

27 08 01 Preliminary Closeout Review (Verification Report)

- ❑ Upon substantial completion of the specific system, test the entire system including primary functions as defined in Division 27 or 28. Document, on a contractor generated form, the compliance of each circuit, the individual performing the test will initialize, and date the results of each location.
- ❑ Submit a written report detailing the results of initial adjustments and verification tests including all relevant drawings, charts, and photographs. This report will be completed and submitted to the Owner or Owner's Agent for review at least five (5) days prior to acceptance testing.

27 08 02 Final Closeout Review – Commissioning/Acceptance Testing

- ❑ The Acceptance Testing and provision of testing equipment will be the responsibility of and performed by the Contractor in the presence of the Owner, Architect, or the Owner's representative. Coordinate this period so that free access, work lighting, and electricity is available on the site. See the commissioning requirements in Divisions 27 or 28.
- ❑ Should the contractor schedule an Acceptance Test and the system or components are not ready for or fail Acceptance Testing, the contractor will pay for all subsequent trips and man-hours required for the consultant to properly document specification conformance by the contractor. The Owner will have the right to reduce pay requests or final application of payment to the contractor in an amount equal to the travel costs and man-hours expended by the Consultant and charged to the contractor. The Owner would then pay the Consultant from the funds withheld from the contractor.

- ❑ Upon witness of the Acceptance Testing and the determination, in the owner's opinion, that a

contractor has falsified the verification test reports; the owner has the right to hire an Independent Testing Agency to provide outside verification of the results. Falsification of the test results is defined as cables shown as testing correctly in the verification report failing during the acceptance testing. (The contractor has the right to hire directly an Independent Testing Agency approved by the owner.) Furthermore, the owner will have the right to reduce pay requests or final application of payment to the contractor in an amount equal to the travel costs and man-hours expended by the Independent Testing Agency. The owner would pay the Independent Testing Agency from the funds withheld from the contractor

27 08 10 Commissioning of Structure Cabling Systems

- ❑ Review of Overview of Testing, Division 01 45 23.01
- ❑ Upon substantial completion of the data network, test every data port for the functional requirements as listed in previously. Document, on a contractor generated form, the compliance of every port. The testing individual will initialize the results of each location. Submit an electronic copy of the reports detailing the results of initial adjustments and verification tests including all relevant drawings, charts, and photographs.
- ❑ Copper Cable Tests - Test and document results for each four (4) pair UTP data cable for the following conditions. (These tests are minimum requirements for Cat 3 Cable). A wire map test of the cable may be used to demonstrate conformance of the cable to the following parameters where applicable.
  a. Proper polarity;
  b. No reversals;
  c. No transpositions;
  d. Continuity;
  e. No shorts
  f. No AC voltage;
  g. No DC voltage
  h. No opens;
  i. Proper numbering at each termination
- ❑ Each permanent link or channel in the network must be field tested in accordance with the TIA-568-B.2-1 series industry standard testing requirements. The installed permanent links and channels must have passed all applicable TIA performance requirements. Minimum testing for copper systems includes Wire Map, Length, Attenuation, Near End Crosstalk, Far End Crosstalk, Return Loss, PS NEXT, ELFEXT, PS ELFEXT.

  All wiring shall be certified to meet or exceed the specifications as set forth in ANSI/TIA-568.2-D for Category 6a requirements for permanent link.

Field Testing shall include the following parameters for each pair of each cable installed:

a. Store number and name.
b. Test equipment manufacturer and model number.
c. Cable I.D. The test sheets will be in numerical order by cable ID.
d. Date of test.
e. Wire map (pin to pin connectivity and polarity check) i.e. near 12345678, far 12345678.
f. Length (in feet).
g. Insertion Loss.

h. Near End Crosstalk (NEXT).
i. Power Sum Near End Crosstalk (PSNEXT).
j. Equal-Level Far End Crosstalk (ELFEXT).
k. Power Sum Equal-Level Far End Crosstalk (PSELFEXT).
l. Return Loss.
m. Delay Skew.
n. Attenuation to Crosstalk ratio (ACR).
o. DC Resistance per 100M/328 feet.
p. Impedance.Permanent

Link Testing shall be completed on all horizontal (station) cables as a minimum requirement. Provide electronic copies of tests for every cable as part of the Verification Test Report.

- ❑ Fiber Testing
- ❑ Factory Testing. All fiber optic cable shall be factory tested on a reel basis with performance data for each cable supplied to the contractor and to the owner. Tests shall be conducted utilizing an OTDR (Optical Time Domain Reflectometer) at 1310nm and 1550nm with the attenuation in dB/km recorded for each fiber. Post Rough-In Test. Upon completion of the installation of all fiber optic cable and prior to termination, each fiber optic strand shall be tested for light continuity to insure no damage occurred during installation. (The contractor may wish to perform a light continuity test on each fiber optic strand of the cable upon receipt of reel from the manufacturer to insure no damage occurred during shipping.
- ❑ Termination Testing - After completion of the installation provide the following tests. An Optical Test Set consisting of an Optical Source (transmitter) and Optical Meter (receiver) will be used to determine end-to-end attenuation and fiber length. This testing is in Accordance with EIA/TIA-526-14 Method B: Optical Power Loss Measurement of Installed Single-mode Fiber Optic Plant. Each fiber should be measured in one direction at both 1310 and 1550 wavelengths. Record each measurement and provide copies to the owner.
- ❑ **An electronic copy of ALL test results related to the above work performed shall be delivered to the Technology department upon substantial completion of the project.**

END OF SECTION

SECTION 270500

DATA AND VOICE COMMUNICATIONS

PART 1 GENERAL

1.01 SUMMARY

Section includes termination devices, racks, and premises wiring for telephone and data communication circuits by certified manufacturers and contract installers with certification and testing of all equipment and cabling.

1.02 RELATED SECTIONS

A. General Electric

B. Conduit

C. Boxes

D. Wiring Devices

1.03 REFERENCES

A. TIA/EIA 568 (Telecommunications Industries Association/Electronic Industries Association) - Commercial Building Telecommunication Wiring Standard.

B. TIA/EIA 569 (Telecommunications Industries Association/Electronic Industries Association) - Commercial Building Standard for Telecommunications Pathways and Spaces.

C. TIA/EIA 606A Administrative Standard (Labeling).

D. TIA/EIA 607 - Commercial Building Grounding/Bonding Requirements.

E. NETA ATS (International Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

F. NFPA 70 - National Electrical Code.

G. UL 969 - Standard for Marking and Labeling Systems.

H. ISO/IEC 11801 - Information Technology, Generic cabling for customer premises.

I. BISCI - Building Industries Consulting Services International.

J. BISCI TDMM - Telecommunications Distribution Methods Manual.

K. BISCI CO-OSP - Customer Outside Plant Design Manual

L. New Hanover County Schools Standard Specification dated **August 2021** Division 27 Communications

1.04 SYSTEM DESCRIPTION

A. Provide, ready for operation, a complete and operational communication network system that is a manufacturer certified Category 6A system. The system shall include, but not be limited to, cabling

(copper and fiber optic), cable protectors, patch panels, racks, faceplates, connectors, hardware, accessories, connections, grounding, and all other material, labor and operations required for a complete system in this building.

B. Cabling shall be installed in conduit as shown on the Drawings. Cable support structure shall be as specified hereinafter.

C. The horizontal wiring shall consist of the wiring from the wall mounted – Thinline IDF cabinet to the information services outlet. (The horizontal wiring includes the wiring termination components in the IDF cabinet, the horizontal wiring itself, and the termination components at the outlet).

D. The horizontal wiring shall consist of the wiring from the wall mounted – Thinline IDF cabinet to the information services outlet. (The horizontal wiring includes the wiring termination components in the IDF cabinet, the horizontal wiring itself, and the termination components at the outlet).

E. Backbone cabling shall consist of fiber (optical fiber cabling) and copper cables to connect data and voice services as required and/or as shown on the Drawings.

F. The system shall provide for current and future voice and data requirements by a planned end-to-end manufacturers system, while recognizing the need for future bandwidth and fault tolerance. The proposed system shall utilize a network of fiber optic and unshielded twisted pair (UTP), riser, tie and station cables. Fiber cables shall terminate on Fiber Distribution Centers and/or modular patch panels as required and/or as shown on the Drawings. Cables and terminations shall be identified at all locations and cables shall terminate in an alphanumeric sequence at all termination locations. The complete system shall be fully standards compliant with guaranteed AChannel performance. All UTP end-to-end Channel Configurations as defined by TIA/EIA 568B-1,2,3 shall be provided by a single manufacturer.

1.05 SUBMITTALS

A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Certifications: Copies of Cable Installation Technician Certifications shall be submitted with the equipment shop drawings. See also Paragraph 2.1.

C. Product Data: Submit catalog data for each termination device, cable, rack, etc.

D. Test Reports: Indicate procedures and results for specified field testing and inspection.

E. Test Cables on receipt at Project site:
   1. Test optical fiber cable to determine the continuity of the strand end to end. Use 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.

1.06 CLOSEOUT SUBMITTALS

A. Submit under provisions of relevant sections of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Project Record Documents: Record actual locations and sizes of pathways and outlets.

C. Provide a certificate of completion of the installation with verifications that each copper cable pair has been tested to Category 6a standards.

D. Provide a certificate of completion of the installation with verifications that each fiber optic cable has been tested to industry standards.

E. Provide a Certified Installation Warranty Certificate.

F. Provide Test results for each cable and outlet.

G. Provide marked up Drawings showing additions, deletions, and modifications also identifying cable routs.

H. Provide electronic copies of marked up final Drawings.

I. Provide wall mounted copies of the final system Drawings in each telecommunications room.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in installing products specified in this section with minimum five years documented experience on projects utilizing infrastructure work similar to that required for this project, and with service facilities within 100 miles of project.

1. The Installer shall be an experienced firm regularly engaged in the layout and the installation of cabling infrastructure systems. Documentation shall be provided to show that the Contractor has successfully completed projects of similar size and scope within the previous twelve months.
2. The Telecommunication Project Manager shall:
   a. be certified as BICSI RCDD
   b. be experienced in this type of project and provide technical support.
   c. attend monthly progress meetings and additional meetings as scheduled or required.
   d. be a permanent employee. Use of a temporary employee or sub-contracted employee is not permitted.
3. Contractor and authorized sub-contractors shall use manufacturer certified technicians for all cable terminations, use of temporary or un-certified technicians is not permitted.

C. Testing Agency: Company member of International Electrical Testing Association and specializing in testing products specified in this section with minimum three years documented experience.

1.08 PRE-INSTALLATION MEETING

Convene minimum one week prior to commencing Work of this section.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: New Hanover County Schools (NHCS) require a Structured Cabling Solution. All cabling and hardware shall be compatible with existing system.

2.02 COMMUNICATIONS HORIZONTAL CABLES

A. Optical Fiber Cable

1. Description: Single mode, 12 -fiber, nonconductive, tight buffer, optical fiber cable.

a. Comply with ICEA S-83-596 for mechanical properties.
b. Comply with TIA/EIA-568-B.3 for performance specifications.
c. 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:
i. General Purpose, Nonconductive: Type OFN or OFNG
ii. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
iii. Riser Rated, Nonconductive: Type OFNR complying with UL 1666.
d. Maximum Attenuation: 0.4 dB/km at 1310 nm; 0.4 dB/km at 1383 nm; 0.3 dB/km at 1550 nm.

2. Jacket:
a. Jacket Color: Orange
b. Cable cordage jacket, fiber, unit, and group color shall be according to TIA/EIA-598-B.
c. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches (1000 mm)

B. Optical Fiber Cable Hardware
1. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
a. 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.
2. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths. Provide quantities required for patch panels installed plus 25% spare.
3. Cable Connecting Hardware:
a. 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.
b. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.

C. UTP Cable
1. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket and white thermoplastic jacket for voice.
a. Comply with TIA/EIA-568-B.1 for performance specifications.
b. Comply with TIA/EIA-568-2-D, Category 6.
c. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
i. Communications, General Purpose Rated: Type CM or CMG.

D. UTP Cable Hardware
1. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-D.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
2. Connecting Blocks: 110-style IDC for Category 6a. 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.
3. 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.
a. Number of Jacks per Field: One for each four-pair UTP cable, plus spares and blank positions adequate to suit specified expansion criteria.
4. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
5. Patch Cords: Factory-made, 4-pair cables in 48-inch (1200-mm) lengths; terminated with 8-position modular plug at each end.
a. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6a performance. Patch cords shall have latch guards to protect against snagging.

2.03 BUILDING ENTRANCE PROTECTORS

Provide building entrance protectors which shall be 66 IN termination and 66 OUT termination configured as standard 489ACA1-100 fully loaded with 4c1s protector 5-pin protector modules. Provide rack mounted protectors where indicated or where required.

2.04 COMMUNICATIONS FACEPLATES AND 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. Four-port-connector assemblies mounted in multigang faceplate.
   3. See drawings for other outlet quantities for number of ports. Mount assemblies in multigang faceplate.
   4. Metal Faceplate: Stainless steel, complying with requirements in Section "Wiring Devices."
   5. Flush mounting snap-in jacks.
   6. Provide blanks for unused portions of faceplates.
   7. Legend: Machine printed, in the field, using adhesive-tape label.

C. Access Point Outlets: The typical outlet to be installed for almost all locations will be a one port surface mount box (biscuit jack). The will be equipped with the appropriate number of Category 6a cables.

2.05 RACKS, PATCH PANELS AND IDF CABINETS.

A. Station cable terminations shall be accomplished using patch panels with 66 style IDC connectors. Patch panels will not exceed 2 RU (3.5”) in height.

B. Telephone backbone and station cables shall be terminated on 66 style terminal blocks. The number of blocks will be determined by installed cables plus 20% capacity. Mount blocks on the telephone backboard in accordance with BICSI TDMM specification for telephone backboards.

C. Fiber Optic cables shall be terminated in rack mount enclosures in each wiring closet. Enclosures shall be sized based on installed cable count plus 10% spare capacity.

D. ER outlets consist of: (2) 6L-20p, (1)L14-30p, at least 2 double duplex 20 amp standard outlets, all attached to rack(s). Coordinate with owner on placement locations.

E. TR outlets consist of: (4) 6L-20p, at least 1 double duplex 20 amp standard outlets, all attached to rack(s). Coordinate with owner on placement locations.

F. Patch Panels: TIA/EIA 568D Category 6a compliant rack-mounted assembly or terminals and accessory patch cords, with adequate capacity for all active and 25% spare circuits.

G. Patch Cables ER & TR: Provide Category 6 green patch cords for all patch panel jacks, evenly divided between 3, 5 and 7 foot cords, plus 15% spare of each length. Cables shall be of the same manufacturer as that of the patch panels. Patch cables are to be installed by the communications contractor and coordinated with NHCS IT dept.

H. Patch Cables ER & TR: Provide Category 6a yellow patch cords for the wireless access point communication network for all patch panel jacks, evenly divided between 3, 5 and 7 foot cords, plus 15% spare of each length. Cables shall be of the same manufacturer as that of the patch panels. Patch cables are to be installed by the communications contractor and coordinated with NHCS IT dept.

I. Outlet Patch Cables: Provide one Category 6 green patch cord for all telecommunications inserts/jacks of appropriate length to ensure proper connectivity to the access point. Cables shall be of the same manufacturer as that of the patch panels. All patch cords supplied shall be from an approved manufacturer. Outlet patch cables will be installed by NHCS.

J. Access Point Outlet Patch Cables: Provide one Category 6a yellow patch cord for all access point jacks throughout the facility, evenly divided into 7, 10 and 15 foot cords, plus 15% spare of each length. Cables shall be of the same manufacturer as that of the patch panels. All patch cords supplied shall be from an approved manufacturer. Access Point Outlet patch cables will be installed by the contractor.

K. Communication Cable Management and Ladder Rack
   1. Horizontal Cable managers shall be provided for routing of cable between termination points and active components. Provide cable managers for each patch panel and/or fiber enclosure in a rack plus one spare. Provide cable managers for each patch panel and/or fiber enclosure in a rack plus one spare. Example, if an TR rack has three switches it would receive 4 wire managers. The passive rack has three patch panels and one fiber enclosure. It would receive 5 wire managers.
   2. Vertical Cable managers shall be provided for routing of cable between termination points and active components. Provide 12”wide vertical cable managers of appropriate height. Provide one manager for exterior of each rack and one in between racks if more than one rack is installed.
   3. A system of overhead ladder racks shall be installed in each TR to support and distribute all cabling from where it enters the room to its appropriate termination location. Racks shall be 12” wide min. with 9” spacing between support rungs.
   4. Overhead ladder racks shall be installed below finished ceiling, mounted at 7’- 4” and attached to the equipment racks and walls. They shall be supported at least every 6”. One cable runway support bracket shall be mounted on top of each equipment rack. Ladder rack shall be bolted to the top of each cable runway support bracket to allow attachment to the equipment rack.
   5. Vertical ladder racks shall be installed to tie into any wireways and conduits that enter the TR above 9’ AFF. All vertical ladder racks shall be connected to the horizontal ladder rack system.

L. IDF Cabinet shall be wall-mounted Thinline II (26” x 26” x 12”) or equal.

M. Station cable terminations shall be accomplished using patch panels with 66 style IDC connectors. Patch panels will not exceed 2 RU (3.5”) in height.

N. Telephone backbone and station cables shall be terminated on 66 style terminal blocks. The number of blocks will be determined by installed cables plus 20% capacity. Mount blocks in IDF Cabinet.

O. Fiber Optic cables shall be terminated in IDF Cabinet.

P. Provide receptacle in IDF Cabinet.

PART 3 EXECUTION

3.01 INSTALLATION

A. The project manager and crew shall be consistent through out the project. The project manager shall be present when any work is being performed. The project manager shall contact the Owner designated contact at the beginning and end of each day that work is to be performed.

B. Cable shall be installed and terminated per manufacturer’s specifications.

C. Notify the Owner when ready for Owner-furnished equipment to be installed.

D. Install wire and cable in accordance with TIA/EIA 568B.1,2,3 and TIA/EIA 569A.

E. All cable shall be in conduit.

F. All penetrations through walls and floors shall be sleeved. All sleeves shall have permanently attached bushings. Sleeves shall be sized to accept 50% growth. All sleeves shall be fire-stopped using UL7 approved methods and shall maintain assembly fire ratings. All sleeves between floors shall be supported with a conduit riser clamp installed per the manufacturer direction and shall be installed tight to the ceiling with enough sleeve to attach the bushing and rise up three inches above the floor on the opposite end.

G. Existing sleeves and wall penetrations may be used provided no sleeve exceeds a 40 percent fill ratio. If using an existing sleeve, it shall have a permanently attached bushing, the contractor shall protect all existing cables and be responsible for any damage to existing cables. All existing sleeves and penetrations shall be firestopped and meet state and local codes at the completion of the installation.

H. All cable shall be installed in a complete, neat and orderly fashion. Install cable with sufficient bending radius as not to kink, shear or damage binders. Bend radius shall meet manufacturers specifications for horizontal cable, fiber-optic cable, inter- and intra- building cable and copper inter- and intra- building cable. Cables shall be groomed, such that cables to be terminated on the left side of the patch panels are routed down the left side of the rack, and cables to be terminated on the right side of the patch panels are to be routed down the right side of the rack.

I. Terminate all data and telephone cables at outlet devices. Terminate data cables on specified rack designated by the manufacturer's end-to-end solution equipment. Terminate telephone cables on specified rack using manufacturer's end-to-end solution for Cat 6a.

J. Install pullwire in each empty telephone or data conduit.

K. A minimum of three feet of slack should be left in an appropriate tidy fashion in the IDF Cabinet.

L. All cables shall be installed according to TIA/EIA 568B-1,2,3 /569A standards. Care shall be taken during the installation to prevent nicks, abrasions, burning and scuffing of the cable. Cables found to be damaged will be replaced at the contractor's expense regardless of whether the cable passes Cat 6 Level III testing standards.

3.02 GROUNDING AND BONDING

A. Ground and bond pathways, cable shields, racks and equipment under the provisions of Section 260526 and TIA/EIA - 607 - Commercial Building Grounding/Bonding Requirements.

B. Grounding conductors shall be installed neatly, with as few bends as possible, and routed such as to minimize the length of the conductor runs.

C. The grounding conductors may be wall mounted or fastened to ladder racks with plastic cable ties. While they may be routed adjacent to telecommunications cables, they should not be attached to them in any way.

D. An acceptable bond between the grounding conductor and painted metal surfaces is required. In these cases, a small area of the paint should be removed by blade or wire brush prior to the attachment of the ground lug. In TRs, this typically applies to the surface of metal wire ways and to the surface of equipment racks.

E. Definitions
   1. Bonding conductor (BC) for telecommunications. This conductor links the
   2. telecommunications grounding system to the main electrical power grounding system for the building. It originates in the TR.
   3. Telecommunications main grounding bus bar (TMGB). This bar is located in the TR and serves as the hub for the telecommunications grounding system in the entire building. Bond the TMGB to the BC, TBB, and local building steel.
   4. Telecommunications bonding backbone (TBB). This conductor links the TGB in each TC back to the TMGB.

F. Required Grounding Configuration
   1. TGB. One telecommunications grounding busbar shall be installed onto the plywood on the wall of each TC. It shall be installed at 24" AFF. The bar shall be electrically insulated from its mounting bracket.
   2. TBB. One insulated, stranded, #6 copper wire shall be installed from the TGB in the TC to the TMGB in the TR. This conductor shall be routed inside the riser conduit system along side the telecommunications riser cables. It shall be fastened to the TGB.
   3. Equipment racks. A #6 grounding conductor shall be installed between one equipment rack and the TGB using the appropriate grounding lug. The remaining equipment racks shall be connected together in series to the first rack to provide a continuous connection to all racks..
   4. Ladder racks. A #6 grounding conductor shall be installed between one section of overhead ladder rack to the TGB or to one of the equipment racks.
   5. Pathway components. A #6 grounding conductor shall be installed from each distinct wireway or conduit (over 1" in diameter) which exits the TR and houses either horizontal or riser cabling back to the TGB, ladder rack, or equipment rack. As needed, these components may be connected in series to provide a continuous connection to all components. Grounding lugs shall be used to connect the conductor to wireways. Grounding bushings should be installed on conduit ends to connect these conduits to the conductor.

3.03 LABELING

A. Manufacturers Identification: Each major component of equipment shall have the manufacturers name, address, model number, and rating on a plate securely affixed in a conspicuous place. NEMA code ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible.

B. Custom Panel Identification and Nomenclature: Switches, connectors, jacks, receptacles, outlets, cables and cable terminations shall be logically and permanently marked in a manner approved by the Owner. Custom panel nomenclature shall be engraved, etched, or screened. Marking for these items are purposely detailed in the drawings to ensure consistency and clarity. Verify any changes in working type size, and/or placement with the owner prior to marking. Mount on the custom rack panels as described above a designation of each source machine, which correlates to the system architecture. Submit a sample layout for Architect approval.

C. Terminal Blocks and Rack Mounted Equipment Identification: All terminal blocks, rack mounted equipment, and active slots of card frame systems shall be clearly and logically labeled in a manner acceptable to the Owner as to their function, circuit, or system as appropriate. Labeling on manufactured equipment shall be engraved plastic laminate with white lettering on black background or dark background. Handwritten identification is not permitted. The contractor may substitute metallized polyester permanent identification labels with black printing on silver, white, or another light color background for the phenolic labels above.

D. Cable Identification: All cable terminations shall be clearly and permanently labeled with appropriate cable number. Labeling of termination system shall be provided on white labels with black typed lettering. Handwritten labels shall not be permitted. Provide a sample of labeling material and example of the numbering scheme planned for use at the facility with project submittals. The contractor will endeavor to utilize the environmental room number the facility administrators plan to

use for new construction projects. If environmental room numbers are not available, the contractor will utilize the most recent set of architectural floor plan room numbers for the cable numbers. Once the contractor has utilized a set of room numbers, those numbers and floor plans showing those numbers must be used for all documentation purposes from that point forward for the project unless changes are approved in writing by the Owners Agent.

E. The intent of this labeling scheme is to assist in troubleshooting cable problems. Therefore the cables are labeled in a manner that will direct the technician to the opposite end of the cable to allow for testing and troubleshooting.

F. All fiber backbone cables will be labeled with a unique identifier at each end and at junction / pull boxes. Fiber backbone cables shall be labeled 12" from each end of the cable with a destination tag that identifies each cable=s remote destination and the unique identifier.

Example: A fiber strand from Room 503 to the MDF 500D would be labeled:
In MDF 500D: = ARoom 503-O1@
In Room 503: = ARoom 500D-O1@
Example: A fiber cable from Room 617A would be labeled:
In MDF 500D: ARoom 617A-O4@
In Room 617A: ARoom 500D-O4@

G. All telecommunication outlet (TO) cables shall be labeled within 12" of each end of the cable using the above described identifier. TO numbers in each room are determined by numerical sequence starting from the main doorway of each room and continuing in a clockwise manner around the room. Each faceplate containing data ports shall be labeled starting in the upper left hand corner of each 1 gang section and assigned in a left to right and top to bottom direction.

H. Switch: Ports shall be labeled using the Room ID- Port ID of the TO serviced by the patch panel port. Telecommunication Outlets (TO) that are serviced by a patch panel will be labeled using IDF ID - Patch Panel ID - Port ID. Example: Patch panel AA@, Port 26 in Room 500D servicing Port #2 in Room 500 = 500D-A-26

I. All test report documentation will contain a complete circuit identification based on the applicable labeling scheme.

3.04 TESTING

A. A Certified Cat 6a cable tester, Level III, shall perform the certification test on all Cat 6a cables and adhere to TIA/EIA-568D.

B. All test equipment shall be consistent throughout the installation. All test equipment shall be available for inspection by the Owner at any time. A valid and current calibration certificate traceable to the National Institute of Standards and Technology for any test equipment to be used shall be provided to the Owner.

C. Upon substantial completion of the data network, test every data port for the functional requirements as listed in previously. Document, on a contractor generated form, the compliance of every port. The testing individual will initialize the results of each location. Submit a electronic copy of the reports detailing the results of initial adjustments and verification tests including all relevant drawings, charts, and photographs.

D. Copper Cable Tests: Test and document results for each four (4) pair UTP data cable for the following conditions. (These tests are minimum requirements for Cat 3 Cable). A wire map test of the cable may be used to demonstrate conformance of the cable to the following parameters where applicable.

a. Proper polarity
b. No reversals
c. No transpositions
d. Continuity
e. No shorts
f. No AC voltage
g. No DC voltage
h. No opens
i. Proper numbering at each termination

All Cat 6a (Enhanced Category 5) UTP cable testing shall be in accordance with proposed TIA/EIA TSB-67 Transmission Performance Specification test parameters for the permanent link. Testing shall be performed using Level IIe test equipment and shall meet or exceed the following performance parameters:

a. Length of cable =/< 90 meters/300 feet
b. Attenuation @ 100Mhz =/<24dB
c. Pair-to-Pair Near-end Crosstalk (P-P NEXT) =/> 30dB
d. Power Sum Near-End Crosstalk (PS NEXT) =/> 27dB
e. Far-End Crosstalk (ELFEXT) =/> 19dB
f. Power Sum Far-End Crosstalk =/> 16dB
g. Return Loss =/> 10.1 dB
h. Calculated ACR =/> 6dB
i. Calculated PS ACR =/> 3dB

E. Fiber Testing

1. Factory Testing: All fiber optic cable shall be factory tested on a reel basis with performance data for each cable supplied to the contractor and to the owner. Tests shall be conducted utilizing an OTDR (Optical Time Domain Reflectometer) at 850nm and 1300 nm with the attenuation in dB/km recorded for each fiber.
2. Post Rough-In Test: Upon completion of the installation of all fiber optic cable and prior to termination, each fiber optic strand shall be tested for light continuity to insure no damage occurred during installation. (The contractor may wish to perform a light continuity test on each fiber optic strand of the cable upon receipt of reel from manufacturer to insure no damage occurred during shipping.
3. Termination Testing: After completion of the installation provide the following tests. An Optical Test Set consisting of an Optical Source (transmitter) and Optical Meter (receiver) shall be used to determine end-to-end attenuation and fiber length. This testing shall be in Accordance with EIA/TIA-526-14 Method B: Optical Power Loss Measurement of Installed Multi-mode Fiber Optic Plant. Each fiber shall be measured in one direction at both 850 and 1300 wavelengths. Record each measurement and provide copies to the Owner. Use of an OTDR for this measurement is acceptable provided the Contractor utilize the appropriate launch and receive jumper cables in front of and behind the cable being tested.

F. Test parameters shall be verifiable by independent parties. Provide electronic copies of tests for every cable as part of the Verification Test Report.

G. The Contractor is responsible for bringing any copper or fiber that fails to meet the standards into compliance at the Contractors expense.

H. An electronic copy of ALL test results related to Voice/Data communication system shall be delivered to the Technology department upon substantial completion of the project.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing shall be performed under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Inspect, test and certify all cabling and equipment and terminations as specified and in accordance with TIA/EIA 568 B.

3.06 WARRANTY

A. The Contractor shall provide the following minimum warranty:
   1. All materials and equipment shall be new and warranted free of faulty workmanship and damage.
   2. The warranty shall include all parts, labor (including travel), expenses and equipment necessary to perform replacement and/or repairs.
   3. The total system (parts and labor) shall be warranted free of defects for a period of one (1) year from date of final acceptance.
   4. Replacement of defective materials and repair of faulty workmanship shall take place within 48 hours of notification by Owner and shall be guaranteed at no cost to the Owner during the warranty period.
   5. The minimum warranty provisions specified above shall not diminish the terms of individual equipment manufacturers warranties.

END OF SECTION

SECTION 270510
TELECOMMUNICATIONS PATHWAYS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Premises wiring raceways and outlets.

B. Backboards.

C. Equipment racks and cabinets.

D. Grounding.

1.02 REFERENCES

NFPA 70 – National Electrical Code.

1.03 SYSTEM DESCRIPTION

Individual and combination telecommunications/data outlets shall be installed where shown on the contract drawings. Raceways shall be installed as straight as possible and shall contain not more than the equivalent of three quarter bends.

1.04 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. Provide a sample of labeling materials and example of the labeling scheme planned for use at the facility. Labeling scheme shall be coordinated in advance with the Owner.

D. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

B. Record actual locations and sizes of pathways and outlets.

1.06 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, 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.

1.07 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.

1.08 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish Products listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

PART 2 - PRODUCTS

2.01 TELECOM TERMINATION BACKBOARDS

A. Material: Grade A/C Fire retardant treated plywood.

B. Size: 4 x 8 feet (1.2 x 2.4 m), 3/4 inch (19 mm) thick.

2.02 EQUIPMENT RACKS

A. Description: Four- post racks with threaded rails designed for mounting telecommunications equipment. Width is compatible with EIA/ECIA 310-E, 19-inch (482.6-mm) equipment mounting with an opening of 17.72-inches (450-mm) between rails.

B. General Requirements:
   1. Frames: Modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   2. Material: Extruded steel.
   3. Finish: Manufacturer's standard, baked-polyester powder coat.

C. Wall-Mounted, Hinged Racks, Panduit PanZone or approved equal:
   1. Height: 26 inches.
   2. Depth: 23 inches.
   3. Width: 25 inches.
   4. Wall Attachment: Four mounting holes.
   5. Equipment Access: Integral swing.
   6. Smoked Glass Front.

2.03 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. Conduit and Boxes: Comply with requirements in Section "Raceway and Boxes for Electrical Systems."
   1. Conduits for backbone cables shall utilize elbows that are long radius or wide sweep.
   2. 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.
   3. Spare conduits and innerducts shall have pull strings installed for future use.

D. Conduit Sleeves:
   1. Sleeves between floors above should be stubbed into the upper level telecom room 12” AFF and extend down 24” below the ceiling slab on the lower level.
   2. Sleeves through floors shall be supported with a conduit riser clamp.
   3. Sleeves shall have permanently installed bushings.

2.04 TELECOMMUNICATIONS OUTLETS

Outlets shall consist of standard, square cornered boxes 4-11/16” wide by 4-11/16“ high by 2-1/8” deep, minimum, flush mounted at the height indicated on the contract drawings. Provide a single gang plaster ring for the square cornered boxes 4-11/16” wide by 4-11/16“ high by 2-1/8” deep.

2.05 TELECOM WIRE AND CABLE

All telephone, data and fiber cable shall be furnished and installed by the contractor.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Support raceways and backboards under the provisions of Section 260529.

B. Install termination backboards plumb, and attach securely to building wall at each corner.

C. Install #14 gauge steel or approved, 200 lb. nylon cord pull wire in each empty conduit run. The maximum bends between pull points shall be 180 degrees.

D. The maximum distance between pull boxes shall be 100 feet.

E. Grounding: All equipment racks, cabinets and systems must be properly connected to the independent ground bus per the ANSI/TIA/EIA 607 specifications. It is the responsibility of the cable installer to connect all common closet equipment racks and cabinets to the provided ground bus. It is also the responsibility of the cable installers to report to the NHCS Program Manager any discrepancies with respect to improper or omitted grounding systems.

END OF SECTION

SECTION 275116

PUBLIC ADDRESS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes equipment, accessories, and materials to provide a complete and operational system for paging, building wide announcements, bell schedule tones, and life safety warnings.

1.03 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.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of product. The specific item proposed and its area of application shall be marked on the catalog cut sheets.

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. 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.
      d. Clearly differentiate between portions of wiring that are manufacturer installed and portions that are field installed.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installing Contractor showing factory authorized certification as an authorized distributor.

B. Qualification Data: For Installer showing factory authorized training.

C. Field quality-control reports.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For public address systems to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in "Closeout Procedures" and "Operation and Maintenance Data," include the following:
    a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
    b. Operating instructions laminated and mounted adjacent to operating console location.
    c. Training plan.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
    1. Microphone: [**One**] <**Insert number**>.
    2. Microphone Desk Stand(s): [**One**] <**Insert number**>.

1.08 QUALITY ASSURANCE

A. The system shall be supplied by a manufacturer's authorized contractor who is qualified in the proper installation, operation, and service of the system.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1.09 WARRANTY

A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within one year from date of installation, repair or replace any equipment found to be defective. This warranty shall not apply to any equipment that has been subject to misuse, abuse, negligence, accident, or unauthorized modification.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The equipment specified is based on equipment as manufactured by Bogen Communications as a Bogen Multicom Quantum IP system. The existing system is a Bogen system and all components installed shall be Bogen.

B. Where equipment is specified herein or on drawings, by manufacturers' names or numbers, this shall denote the Design Basis for the preferred alternate bid and the minimum requirements as to quality, type, capacity, function, and performance.
    1. Where a specific model may have been discontinued, the manufacturer's intended replacement shall be substituted. Such substitutions shall be identified in the submittals.

C. Source Limitations: Obtain public address system from single source from single manufacturer.

D. 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.

E. Comply with NFPA 70.

2.02 ADMINISTRATIVE PHONE

Design Basis: Bogen Model MCESS.

2.03 LOUDSPEAKERS

A. Classroom, Corridor, and Administrative Loudspeakers:
   1. Flush-Ceiling-Mounted Units: In steel back boxes, acoustically dampened. Metal ceiling grille with white baked enamel.
   2. Design Basis: Bogen Model CSD2X2VR.
   3. Design Basis: Bogen Model WBS8T725V for Wall Mount.

B. Horn-Type Loudspeakers:
   1. Mounting: Integral bracket.
   2. Units in Damp, Wet, or Outdoor Locations: Listed and labeled for environment in which they are located.
   3. Design Basis: Bogen Model FMH-15T.

2.04 SURGE SUPPRESSION

A. Provide surge suppression protectors for any intercom cables that enter from outside the building and on all exterior horn circuits.

B. Provide protectors for any intercom cables that enter the equipment rooms from outside the building. Examples of this would be outside horns and mobile classrooms.

C. Design Basis: ITW LINX #UP25-39.

2.05 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 thick.
   2. Cables 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. Each cable identification shall be a unique number located approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings provided by the installer and these drawings shall be mounted in each equipment room used to support any part of the entire system.
   3. Design Basis:
      a. Corridors & Exterior Horns: Belden 5300FE, #18 AWG.
      b. Classrooms, Admin, & Locations other than Corridors: West Penn 291 #22 AWG.

2.06 PATHWAYS

A. Conduit, Cable Tray, and Boxes: Comply with Sections "Raceways and Boxes" and "Wire Mesh Cable Trays".
   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

3.01 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 where unenclosed wiring method may be used. Conceal pathway and cables except in unfinished spaces.

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.

3.02 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. 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. Service Loops:
      a. Provide 10 foot service loops at each equipment termination so that plates, panels, and equipment can be dismounted for service and inspection.
      b. Provide 3 foot service loops at each loudspeaker.
   7. 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 24 inches above ceiling by cable supports not more than 60 inches apart. Cables shall be installed parallel or at 90 degree angles to the building walls. Diagonal, beeline, or non-supported cable routing is unacceptable.
   3. Cable shall not be run through structural members or be in contact with pipes, ducts, or other potentially damaging items.
   4. Utilize wall sleeves, dedicated to low voltage cabling, for penetrations through walls.

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 apart for speaker microphones and adjacent parallel power and telephone wiring. Separate other communication equipment conductors as recommended by equipment manufacturer.

3.03 INSTALLATION

A. The contractor shall furnish all equipment, accessories, and material required for the installation of a comprehensive communication system 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.

B. 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.

C. Match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

D. 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.

E. Equipment Cabinets and Racks:
   1. Group items of same function together, either vertically or side by side, and arrange controls symmetrically. Mount monitor panel above the amplifiers.
   2. Arrange all inputs, outputs, interconnections, and test points so they are accessible at rear of rack for maintenance and testing, with each item removable from rack without disturbing other items or connections.
   3. Blank Panels: Cover empty space in equipment racks so entire front of rack is occupied by panels.
   4. Install cables, combed straight and formed in a neat and orderly manner. Tie as required using Velcro cable ties of appropriate type and size.

F. Volume Limiter/Compressor: Equip each zone with a volume limiter/compressor. Install in central equipment cabinet. Arrange to provide a constant input to power amplifiers.

G. Wall-Mounted Outlets: Flush mounted.

H. Connect wiring according to Section 270500 "Data Voice Communications".

3.04 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. Cable shielding shall be connected to common ground at point of lowest audio level and shall be free from ground at any other point. Cable shields shall be terminated in same manner as conductors.

3.05 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 assist in testing.

B. 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.
   4. Signal-to-Noise Ratio Test: Measure signal-to-noise ratio of complete system at normal gain settings as follows:
      a. Disconnect microphone at connector or jack closest to it and replace it in the circuit with a signal generator using a 1000-Hz signal. Replace all other microphones at corresponding connectors with dummy loads, each equal in impedance to microphone it replaces. Measure signal-to-noise ratio.
      b. Repeat test for each separately controlled zone of loudspeakers.
      c. Minimum acceptance ratio is 50 dB.
   5. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 50, 200, 400, 1000, 3000, 8000, and 12,000 Hz into each preamplifier channel. For each frequency, measure distortion in the paging and all-call amplifier outputs. Maximum acceptable distortion at any frequency is 3 percent total harmonics.
   6. Acoustic Coverage Test: Feed pink noise into system using octaves centered at 500 and 4000 Hz. Use sound-level meter with octave-band filters to measure level at five locations in

each zone. For spaces with seated audiences, maximum permissible variation in level is plus or minus 2 dB. In addition, the levels between locations in same zone and between locations in adjacent zones must not vary more than plus or minus 3 dB.

7. Signal Ground Test: Measure and report ground resistance at public address equipment signal ground. Comply with testing requirements specified in Section 270526 "Grounding and Bonding for Communications Systems."

C. 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.

D. Public address system will be considered defective if it does not pass tests and inspections.

E. 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.

3.06 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform 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.

3.07 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.

B. 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 four visits to Project during other-than-normal occupancy hours for this purpose.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Train Owner's maintenance personnel to adjust, operate, and maintain the public address system and equipment.

B. Provide a minimum of eight (8) hours of complete "in service" instructions of system operation to school personnel. Assist in programming of telephone system.

C. Installer shall provide programming documentation that reflects the relation to each port, station identifier, and physical location of station.

END OF SECTION

SECTION 281300

VIDEO INTERCOM AND ACCESS CONTROL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Reference each product to a location on Drawings.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams. For power, signal, and control wiring. Show typical wiring schematics for equipment installation.

1.03 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Hard copies of manufacturer's specification sheets, operating specifications, user's guides, and PDF files on CD-ROM of the hard-copy submittal.
2. System installation and setup guides.
3. Wiring Diagrams

1.04 QUALITY ASSURANCE

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."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Central Station, Workstations, and Controllers:

1. Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F (10 and 30 deg C), and not more than 80 percent relative humidity, noncondensing.
2. Open each container; verify contents against packing list; and file copy of packing list, complete with container identification, for inclusion in operation and maintenance data.
3. Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.06 WARRANTY

A. Warranty Period: Two years from substantial completion

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. AiPhone (Basis of Design and Preferred Alternate) Other Manufacturers (if meet the spec and are compatible with the existing Aiphone system): EntryVue, Nortek, Panasonic, Siedle, and SVAT.

B. Where equipment is specified herein or on drawings, by manufacturers' names or numbers as a Design Basis, this shall denote minimum requirements as to quality, type, capacity, function, and performance.
   1. Where a specific model may have been discontinued, the manufacturer's intended replacement shall be substituted. Such substitutions shall be identified in the submittals

2.02 SYSTEM DESCRIPTION – HANDS-FREE COLOR VIDEO INTERCOM MASTER MONITOR STATION

A. Answering Door Call in Hands-Free Mode:
   1. Press CALL button.
   2. Chime tone sounds, caller is seen on video monitor, and outside sound is heard.
   3. Audio and video turn off after approximately 45 seconds if not answered.
   4. Press TALK button momentarily, and after beep, communicate hands free. Red transmit LED lights when you talk, and goes off as you listen to caller or hear outside sounds.
   5. After finishing communication, press OFF button and communication will end after beep.

B. Answering Door Call in Press-to-Talk (PTT) Mode:
   1. Press CALL button.
   2. Chime tone sounds, caller is seen on video monitor, and outside sound is heard.
   3. Audio and video turn off after approximately 45 seconds if not answered.
   4. Press and hold TALK button for minimum of 1 second. Beep sounds, and after approximately 1 second another beep sounds, which indicates PTT mode is engaged. If TALK button is pressed less than 0.5 seconds, PTT mode is not engaged.
   5. When communicating, keep TALK button pressed. To hear caller's voice, release TALK button.
   6. After finishing communication, press OFF button and communication will end after beep.

C. Instant-Voice-Call Function:
   1. Press CALL button.
   2. Even without answering, door area can be seen and heard with video and audio for approximately 45 seconds. Inside sound is not heard outside.

D. Activating Door Release:
   1. Press DOOR RELEASE button.
   2. Open door while release mechanism is activated. During release, red DOOR RELEASE LED flashes.

E. Entrance Monitoring:
   1. Press MONITOR button in standby mode.
   2. Video monitor displays image from door station and incoming audio is heard. If you do not press TALK button, caller will not hear sounds from inside station.
   3. Press OFF button to end communication.

F. Room-to-Room Communication:
   1. Press CALL button to talk with other person.
   2. Call-in is sent to sub master station.
   3. Reply of other person is not heard.
   4. If other person presses TALK button, hands-free communication is possible.
   5. Press and release OFF button to end communication.

G. Wide/Zoom Switching:

1. Press ZOOM/WIDE button when picture is displayed.
2. Switching between wide and zoom occurs each time button is pressed.

H. Pan/Tilt Operation:
1. When zoom picture is displayed, press UP, DOWN, LEFT, and RIGHT buttons.
2. Moving diagonally is also possible.

I. Zoom Picture Preset:
1. Picture can be set to display using set zoom picture position for when call is received from door station.
2. When switching from wide picture to zoom picture, zoom picture displays at preset position.
3. When zoom picture is displayed, press UP, DOWN, LEFT, and RIGHT buttons.
4. While viewing picture, set desired picture position.
5. Press ZOOM/WIDE button for minimum of 2 seconds.
6. Beep will sound and position setting will be completed.

J. Night Illumination:
1. At night, door station illuminator LED lights up during calling or communication.
2. When Call is Made from Door Station:
   a. If CALL button of door station is pressed, illuminator LED lights up.
   b. When communication ends, illuminator LED will go out.
3. Light Up Illuminator LED During Entrance Monitoring:
   a. When TALK button is pressed during entrance monitoring, communications starts and illuminator LED will light up.
   b. Inside sound can be heard at entrance.
   c. When communication ends, illuminator LED will go out.

K. Backlight Adjustment, Night Sensitivity Adjustment:
1. To perform adjustment, press ADJUST button when image is difficult to see. Automatic adjustment to more visible screen is performed.
2. To cancel adjustment, press ADJUST button during adjustment.

L. Automatic Recording:
1. If a call is received from video door station, unit starts recording automatically.
2. Red record LED flashes during recording.
3. Recording starts approximately 2 seconds after CALL button of video door station is pressed.
4. Maximum length of approximately 6 seconds (6 shots) can be recorded, with 1 picture and 1 shot for each second.
5. Maximum of 40 images can be recorded (combined total of automatic recording and manual recording images).
6. If 40 images are exceeded, images are overwritten starting from image with oldest recording date.
7. Initial setting is for recording to be done with first 3 pictures as zoom pictures at a preset position, and next 3 pictures as wide pictures.

M. Manual Recording:
1. Display video image with operation such as entrance monitoring.
2. Press REC button. Red record LED flashes 6 times and recording starts.
3. Maximum length of approximately 6 seconds (6 shots) can be recorded, with 1 image and 1 shot for each second.
4. Maximum of 40 images can be recorded (combined total of automatic recording and manual recording images).
5. When 40 images are exceeded, new images overwrite old images starting from oldest recorded date.

N. Play Recorded Picture:
1. Press PLAY button in standby mode to display picture with most recent date.

2. Press PLAY button on play-waiting screen. Recorded image is played. When play of 1 image ends, next image is displayed.
3. To advance play screen frame-by-frame, press PLAY button during playback to pause. Play moves forward frame-by-frame each time DOOR RELEASE button is pressed. When frames of 1 image end, next picture is displayed.
4. Press OFF button to end.

O. Save Recorded Picture:
1. Display picture that you want to save in play-waiting screen. Press MENU button to display save/erase selection screen.
2. Press PLAY button. If image is saved, key symbol is displayed. If image has already been saved, save is cancelled. Each time PLAY button is pressed, operation switches between save and cancel.

P. Erase Recorded Picture:
1. Display picture that you want to erase in play screen. Press MENU/MEMO button to display save/erase selection screen.
2. Press MENU button to erase.
3. Press REC button to stop erasing.
4. Once picture is erased, it cannot be restored.

2.03 SYSTEM DESCRIPTION – HANDS-FREE COLOR VIDEO INTERCOM SUB MONITOR STATION

A. Answering Door Call in Hands-Free Mode:
1. Press CALL button.
2. Chime tone sounds, caller is seen on video monitor, and outside sound is heard.
3. Audio and video turn off after approximately 45 seconds if not answered.
4. Press TALK button momentarily, and after beep, communicate hands free. Red transmit LED lights when you talk, and goes off as you listen to caller or hear outside sounds.
5. After finishing communication, press OFF button and communication will end after beep.

B. Answering Door Call in Press-to-Talk (PTT) Mode:
1. Press CALL button.
2. Chime tone sounds, caller is seen on video monitor, and outside sound is heard.
3. Audio and video turn off after approximately 45 seconds if not answered.
4. Press and hold TALK button for minimum of 1 second. Beep sounds, and after approximately 1 second another beep sounds, which indicates PTT mode is engaged. If TALK button is pressed less than 0.5 seconds, PTT mode is not engaged.
5. When communicating, keep TALK button pressed. To hear caller's voice, release TALK button.
6. After finishing communication, press OFF button and communication will end after beep.

C. Instant-Voice-Call Function:
1. Press CALL button.
2. Even without answering, door area can be seen and heard with video and audio for approximately 45 seconds. Inside sound is not heard outside.

D. Activating Door Release:
1. Press DOOR RELEASE button.
2. Open door while release mechanism is activated. During release, red DOOR RELEASE LED flashes.

E. Entrance Monitoring:
1. Press MONITOR button in standby mode.
2. Video monitor displays image from door station and incoming audio is heard. If you do not press TALK button, caller will not hear sounds from inside station.
3. Press OFF button to end communication.

F. Room-to-Room Communication:
   1. Press CALL button to talk with other person.
   2. Call-in is sent to master monitor station.
   3. Reply of other person is not heard.
   4. If other person presses TALK button, hands-free communication is possible.
   5. Press and release OFF button to end communication.

G. Wide/Zoom Switching:
   1. Press ZOOM/WIDE button when picture is displayed.
   2. Switching between wide and zoom occurs each time button is pressed.

H. Pan/Tilt Operation:
   1. When zoom picture is displayed, press UP, DOWN, LEFT, and RIGHT buttons.
   2. Moving diagonally is also possible.

I. Night Illumination:
   1. At night, door station illuminator LED lights up during calling or communication.
   2. When Call is Made from Door Station:
      a. If CALL button of door station is pressed, illuminator LED lights up.
      b. When communication ends, illuminator LED will go out.
   3. Light Up Illuminator LED During Entrance Monitoring:
      a. When TALK button is pressed during entrance monitoring, communications starts and illuminator LED will light up.
      b. Inside sound can be heard at entrance.
      c. When communication ends, illuminator LED will go out.

J. Backlight Adjustment, Night Sensitivity Adjustment:
   1. To perform adjustment, press ADJUST button when image is difficult to see. Automatic adjustment to more visible screen is performed.
   2. To cancel adjustment, press ADJUST button during adjustment.

K. If Optional Units Installed:
   1. When separately installed sensor detects malfunction or CALL button is pressed, alarm sound occurs and red transmit LED flashes.
   2. Press OFF button to stop alarm sound.

2.04 VIDEO INTERCOM AND ACCESS CONTROL SYSTEM

A. Hands-Free Color Video System with Pan, Tilt, and Zoom: Design Basis: Aiphone JP Series.

B. Hands-Free Color Video Intercom Master Monitor Station: Design Basis: Model JP-4MED.
   1. Power: 24 V DC.
   2. Current Consumption: 400 mA maximum.
   3. Calling: Chime and image, approximately 45 seconds.
   4. Communication:
      a. Hands-Free Mode: Automatic voice activation.
      b. Handset: Simultaneous communication.
   5. Video Monitor:
      a. 7-inch direct-view TFT color, touchscreen LCD.
      b. Pixels: 800 x 480.
   6. Door Release Contact: 24 V AC/DC, 500 mA (N/O dry closure contact L, L).
      a. Minimum Contact: 100 mV DC, 0.1 mA.
   7. Operating Temperature: 32 deg F to 104 deg F (0 deg C to 40 deg C).
   8. Microphone.
   9. Multi-color status LED
   10. DOOR RELEASE button.
   11. Settings button.

12. MENU button.
13. PAN/TILT button.
14. ZOOM/WIDE button.
15. ADJUST button.
16. CALL button.
17. Option button.
18. Home button.
19. TALK button.
20. OFF button.
21. MONITOR button.
22. PLAY button.
23. RECORD button.
24. Speaker.
25. Screen brightness control.
26. Receive volume control.
27. Chime tone volume.
28. SDHC memory card: 64 GB minimum, 95 MB/s minimum.

C. Hands-Free Color Video Intercom Sub Monitor Station: Design Basis: Model JP-4HD.
1. Power: 18 V DC.
2. Current Consumption: 200 mA maximum.
3. Calling: Chime and image, approximately 45 seconds.
4. Communication:
   a. Hands-Free Mode: Automatic voice activation.
   b. Handset: Simultaneous communication.
5. Video Monitor:
   a. 7-inch TFT color touchscreen LCD.
   b. Pixels: 800 x 480.
6. Operating Temperature: 32 deg F to 104 deg F (0 deg C to 40 deg C).
7. Microphone.
8. Settings button.
9. DOOR RELEASE button.
10. ZOOM/WIDE button.
11. ADJUST button.
12. PAN/TILT button.
13. CALL button.
14. Option button.
15. TALK button.
16. OFF button.
17. MONITOR button.
18. Speaker.
19. Screen brightness control.
20. Receive volume control.
21. Chime tone volume.

D. Vandal-Resistant Video Door Station: Design Basis: Model JP-DVF-HID.
1. Faceplate: Stainless steel.
2. Flush mount.
3. Microphone.
4. Speaker.
5. Camera:
   a. Complementary metal oxide semiconductor (CMOS).
   b. Scanning Lines: 525.
   c. Minimum Subject Illumination: 5 Lux at 50-cm (1-foot 6-inch) distance.
6. CALL button.
7. Card reader.
8. Vandal resistant.

9. Weather resistant.
10. Operating Temperature: 14 degrees F to 140 degrees F (minus 10 degrees C to 60 degrees C).

2.05 ACCESSORIES

A. Electric Door Strike: Design Basis: Model EL-12S or door strike suitable for door being released.
1. 12 V AC, 125 mA.
2. 12 V DC, 200 mA.

B. Form C Door Release Relay: Design Basis: Model RY-18L.

C. DC Power Supply: Design Basis: Model PS-2420UL.

D. Door Strike Power Supply: Design Basis: Model PS-914.

E. Desk Mount Stand: Design Basis: Model MCW-S/A.

2.06 CABLES

A. PVC-Jacketed, Aiphone Cables (basis of design):

1. Two (2) conductor (model #871802), non-shielded No. 18 AWG, copper conductors, polyethylene insulation; PVC jacket.
2. Four (4) conductor (model #871804), non-shielded No. 18 AWG, copper conductors, polyethylene insulation; PVC jacket.
3. NFPA 70, Type CM.

2.07 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

3.01 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 cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Construction."

B. Wiring Method: Install wiring in raceway 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.

C. Boxes and enclosures containing security-system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in

occupied areas of the building shall not be considered accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

3.03 STARTUP SERVICE

A. Engage a factory-authorized service representative to supervise and assist with startup service.

B. Installer shall coordinate with owner to adjust system to meet site requirements.

3.04 PROTECTION

A. Protect video intercom system during construction.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain video intercom system.

END OF SECTION

SECTION 281600

INTRUSION DETECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Intrusion detection systems with communication links to perform monitoring, alarm, and control functions.
   2. Duress/panic alarm system.

1.03 DEFINITIONS

A. PIR: Passive infrared.

B. RFI: Radio-frequency interference.

C. UPS: Uninterruptible power supply.

D. Control Unit: System component that monitors inputs and controls outputs through various circuits.

E. Protected Zone: A protected premises or an area within a protected premises that is provided with means to prevent an unwanted event.

F. Standard Intruder: A person who weighs 100 lb (45 kg) or less and whose height is 60 inches (1525 mm) or less; dressed in a long-sleeved shirt, slacks, and shoes.

G. Zone. A defined area within a protected premises. It is a space or area for which an intrusion must be detected and uniquely identified. The sensor or group of sensors must then be assigned to perform the detection, and any interface equipment between sensors and communication must link to master control unit.

1.04 ACTION SUBMITTALS

A. Product Data: Components for sensing, detecting, systems integration, and control, including dimensions and data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: Detail assemblies of standard components that are custom assembled for specific application on this Project.

   1. Functional Block Diagram: Show single-line interconnections between components including interconnections between components specified in this Section and those furnished under other Sections. Indicate methods used to achieve systems integration. Indicate control, signal, and data communication paths and identify control interface devices and media to be used. Describe characteristics of network and other data communication lines.

      a. Describe methods used to protect against power outages and transient voltages including types and ratings of isolation and surge suppression devices used in data, communication, signal, control, and ac and dc power circuits.

2. Device Address List: Coordinate with final system programming.
3. System Wiring Diagrams: Include system diagrams unique to Project. Show connections for all devices, components, and auxiliary equipment. Include diagrams for equipment and for system with all terminals and interconnections identified.
4. Details of surge-protection devices and their installation.
5. Sensor detection patterns and adjustment ranges.

C. Design Data: Include method of operation and supervision of each component and each type of circuit. Show sequence of operations for manually and automatically initiated system or equipment inputs. Description must cover this specific Project; manufacturer's standard descriptions for generic systems are unacceptable.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field quality-control reports.

1. Anchor inspection reports documenting inspections of built-in and cast-in anchors.

C. Product Warranty: Sample of special warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For intrusion detection system to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

1. Data for each type of product, including features and operating sequences, both automatic and manual.
2. Master control-unit hardware and software data.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Intrusion Detection Devices: Furnish quantity equal to five percent of the number of units of each type installed, but no fewer than one of each type.
2. Fuses: Three of each kind and size.
3. Tool Kit: Provide three sets of tools for use with security fasteners, each packaged in a compartmented kit configured for easy handling and storage.

1.08 QUALITY ASSURANCE

A. Installer Qualifications:

1. An employer of workers, at least one of whom is a technician certified by the National Burglar & Fire Alarm Association.
2. Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
3. Holds a North Carolina Electrical Contractors License in one of the following categories: Unlimited, Limited, Intermediate or SP-Low Voltage.

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. Control Units, Devices, and Communications with Monitoring Station: Listed and labeled by a qualified testing agency for compliance with SIA CP-01.

D. Comply with NFPA 70.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Installer agree to repair or replace components of intrusion detection devices and equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Security Alarm system by Honeywell Ademco Vista (Preferred Alternate) Other Manufacturers: Altronis, Bosch, Crow, GE, Optex, Rokonet, Stealth, Visonic

2.02 FUNCTIONAL DESCRIPTION OF SYSTEMS

A. Description: Hard-wired, modular, microprocessor-based controls, intrusion sensors and detection devices, and communication links to perform monitoring, alarm, and control functions.

B. Supervision: System components shall be continuously monitored for normal, alarm, and trouble conditions. Indicate deviations from normal conditions at any location in system. Indication includes identification of device or circuit in which deviation has occurred and whether deviation is an alarm or malfunction.
   1. Alarm Signal: Display at master control unit and actuate audible and visual alarm devices.
   2. Trouble Condition Signal: Distinct from other signals, indicating that system is not fully functional. Trouble signal shall indicate system problems such as battery failure, open or shorted transmission line conductors, or control-unit failure.

C. System Control: Control units shall directly monitor intrusion detection units and connecting wiring.

D. System shall automatically reboot program without error or loss of status or alarm data after any system disturbance.

E. Response Time: Two seconds between actuation of any alarm and its indication at master control unit.

F. Circuit Supervision: Supervise all signal and data transmission lines, links with other systems, and sensors from master control unit. Indicate circuit and detection device faults with both protected zone and trouble signals, sound a distinctive audible tone, and illuminate an LED. Maximum permissible elapsed time between occurrence of a trouble condition and indication at master control unit is 20 seconds. Initiate an alarm in response to opening, closing, shorting, or grounding of a signal or data transmission line.

G. Manual Secure-Access Control: Coded entries at manual stations shall change status of associated protected zone between secure and access conditions.

2.03 SYSTEM COMPONENT REQUIREMENTS

A. Compatibility: Detection devices and their communication features, connecting wiring, and master control unit shall be selected and configured with accessories for full compatibility with the following equipment:
   1. Door hardware specified in Section 087100 "Door Hardware".

B. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor entry connection to components.
   1. Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Lines: Listed and labeled by a qualified testing agency for compliance with NFPA 731.

C. Intrusion Detection Units: Listed and labeled by a qualified testing agency for compliance with UL 639.

D. Interference Protection: Components shall be unaffected by radiated RFI and electrical induction of 15 V/m over a frequency range of 10 to 10,000 MHz and conducted interference signals up to 0.25-V rms injected into power supply lines at 10 to 10,000 MHz.

2.04 2.4 ENCLOSURES

A. Interior Sensors: Enclosures that protect against dust, falling dirt, and dripping noncorrosive liquids.

B. Interior Electronics: NEMA 250, Type 12.

C. Screw Covers: Where enclosures are readily accessible, secure with security fasteners of type appropriate for enclosure.

2.05 2.5 SECURE AND ACCESS DEVICES

A. Keypad and Display Module:
   1. Arranged for entering and executing commands for system-status changes and for displaying system-status and command-related data.
   2. Design Basis: Honeywell #6148.

2.06 DOOR SWITCHES

A. Description: Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of two encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.

B. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame. Metal doors shall employ contacts and magnets designed for use with metal doors.

2.07 PIR SENSORS

A. Listed and labeled by a qualified testing agency for compliance with SIA PIR-01.

B. Description: Sensors detect intrusion by monitoring infrared wavelengths emitted from a human body within their protected zone and by being insensitive to general thermal variations.
   1. Ceiling-Mounted Unit Spot-Detection Pattern, full 360-degree conical, 60’ range. Design Basis: Honeywell/Interlogix AP 669
   2. Ceiling/Wall-Mounted Unit Directional Pattern, wide range use, 89 degree x 50’ detection range minimum. Design Basis: Honeywell/Interlogix AP450
   3. Ceiling/Wall-Mounted Unit Directional Pattern, 200’ long range corridor use. Design Basis: Honeywell/Interlogix AP633

C. Device Performance:
   1. Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard-intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across two adjacent segments of detector's field of view.
   2. Test Indicator: LED test indicator that is not visible during normal operation. When visible, indicator shall light when sensor detects an intruder. Locate test enabling switch under sensor housing cover.

2.08 INTRUSION DETECTION CONTROL UNITS

A. Description: Supervise sensors and detection subsystems and their connecting communication links, status control (secure or access) of sensors and detector subsystems, activation of alarms and supervisory and trouble signals, and other indicated functions.
   1. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
   2. Include a real-time clock for time annotation of events on the event recorder.

B. Comply with UL 609; listed by ETL or UL.

C. Console Controls and Displays: Arranged for interface between human operator at control unit. Display alarm, supervisory, and component status messages and the programming and control menu.
   1. Annunciator and Display: LCD.
   2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
   3. Control-Unit Network: Automatic communication of alarm, status changes, commands, and other communications required for system operation. Communication shall return to normal after partial or total network interruption such as power loss or transient event. Total or partial signaling network failures shall identify the failure and record the failure at the annunciator display and at the system printer. Minimum 2 partition capable.
   4. Field Device Network: Communicate between the control unit and field devices of the system. Communications shall consist of alarm, network status, and status and control of field-mounted processors. Each field-mounted device shall be interrogated during each interrogation cycle.
   5. Operator Controls: Manual switches and push-to-test buttons that do not require a key to operate. Prevent resetting of alarm, supervisory, or trouble signals while alarm or trouble condition persists. Include the following:
      a. Acknowledge alarm.
      b. Silence alarm.
      c. System reset.
      d. LED test.
   6. Alarm Indication: Audible signal sounds and an LED lights at control unit identifying the protected zone originating the alarm. Annunciator panel displays a common alarm light and sounds an audible tone.
   7. Alarm activation sounds a bell or siren and strobe

D. Protected Zones: Quantity of alarm and supervisory zones as indicated, with capacity for expanding number of protected zones by a minimum of 25 percent.

E. Power Supply Circuits: Master control units shall provide power for remote power-consuming detection devices. Circuit capacity shall be adequate for at least a 25 percent increase in load.

F. Transmission to Monitoring Station: A communications device to automatically transmit alarm, supervisory, and trouble signals to the monitoring station, operating over a standard voice grade telephone leased line.

G. Design Basis: Honeywall #VISTA-20P.

2.09 AUDIBLE AND VISUAL ALARM DEVICES

A. Siren: 30-W speaker with siren driver, rated to produce a minimum sound output of 117 dB at 30 feet. Coordinate location with Owner/Architect.
   1. Self-contained outdoor horn with choice of two tones – steady and yelp.
   2. Enclosure: Weather-resistant with mounting swivel.
   3. Design Basis: Honeywell #ZR830EC.

2.10 DURESS / PANIC ALARM SYSTEM

A. Automatic Voice / Pager Dialer:
   1. Design Basis for Preferred Alternate Bid: United Security Products #AD-2001.

B. Power Supply:
   1. Design Basis for Preferred Alternate Bid: United Security Products #PB12P.

C. Duress / Panic Alarm Switches:
   1. Description: A switch with a shroud over the activating lever that allows an individual to covertly send a duress signal to master control unit, with no visible or audible indication when activated. Switch shall lock in activated position until reset with a key.
      a. Push Button: Finger activated, suitable for mounting on horizontal or vertical surface.
   2. Design Basis for Preferred Alternate Bid:
      a. Switch: Honeywell 270
      b. Reset Tool: K4563.

D. Switch Covers:
   1. Design Basis for Preferred Alternate Bid: STI Mini Stopper #STI-65XX Series.

2.11 SECURITY FASTENERS

A. Operable only by tools produced for use on specific type of fastener by fastener manufacturer or other licensed fabricator. Drive system type, head style, material, and protective coating as required for assembly, installation, and strength.

B. Drive System Types: Pinned Torx-Plus, pinned Torx, or pinned hex (Allen

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of intrusion detection.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations of intrusion detection connections before intrusion detection installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of intrusion detection.

D. Inspect built-in and cast-in anchor installations, before installing intrusion detection, to verify that anchor installations comply with requirements. Prepare inspection reports.

   1. Remove and replace anchors where inspections indicate that they do not comply with requirements. Reinspect after repairs or replacements are made.

2. Perform additional inspections to determine compliance of replaced or additional anchor installations. Prepare inspection reports.

E. For material whose orientation is critical for its performance as a ballistic barrier, verify installation orientation.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SYSTEM INSTALLATION

A. Comply with UL 681 and NFPA 731.

B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

3.03 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceways according to Section 260533 “Raceways and Boxes for Electrical Systems.” Conceal raceway except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring Method: Install wiring in metal raceways according to Section 260533 “Raceways and Boxes for Electrical Systems,” except in accessible indoor ceiling spaces and in interior hollow gypsum board partitions where cable may be used. Conceal raceways and wiring except in unfinished spaces and as indicated. Minimum conduit size shall be 1/2 inch (13 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

C. Wiring Method: Cable, concealed in accessible ceilings, walls, and floors when possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system’s wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Wires and Cables:

1. Conductors: Size as recommended in writing by system manufacturer unless otherwise indicated.
2. Control and Signal Transmission Conductors: Install unshielded, twisted-pair cable unless otherwise indicated or if manufacturer recommends shielded cable.

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

G. Install power supplies and other auxiliary components for detection devices at control units unless otherwise indicated or required by manufacturer. Do not install such items near devices they serve.

H. Identify components with engraved, laminated-plastic or metal nameplate for master control unit and each terminal cabinet, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 “Identification for Electrical Systems.”

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with identification requirements in Section 260553 “Identification for Electrical Systems.”

B. Install instructions frame in a location visible from master control unit.

3.05 GROUNDING

A. Ground the master control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to master control unit.

B. Ground system components and conductor and cable shields to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

3.06 FIELD QUALITY CONTROL

A. Pretesting: After installation, align, adjust, and balance system and perform complete pretesting to determine compliance of system with requirements in the Contract Documents. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.

   1. Report of Pretesting: After pretesting is complete, provide a letter certifying that installation is complete and fully operable; include names and titles of witnesses to preliminary tests.

B. Tests and Inspections: Comply with provisions in NFPA 731, Ch. 9, “Testing and Inspections.”

   1. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
   2. Test Methods: Intrusion detection systems and other systems and equipment that are associated with detection and accessory equipment shall be tested according to Table “Test Methods” and Table “Test Methods of Initiating Devices.”

C. Documentation: Comply with provisions in NFPA 731, Ch. 4, “Documentation.”

D. Tag all equipment, stations, and other components for which tests have been satisfactorily completed.

3.07 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 three visits to Project during other-than-normal occupancy hours for this purpose. Visits for this purpose shall be in addition to any required by warranty.

END OF SECTION

SECTION 28 2300A

ELECTRONIC VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.0 GENERAL GUIDELINES

A. New Hanover County Schools is standardizing to the Panasonic I-Pro Series. Proposal shall include solution utilizing equipment within the Panasonic I-Pro Series only. Equipment proposed within the Panasonic I-Pro Series shall be able to perform the following:

1. Progressive scan mega pixel camera able to provide high quality usable security picture in extreme low light conditions down to as low as .08 lux in black & white mode.
2. Auto back focus allowing the camera to automatically re-focus the image every time the camera alternates between color and black & white.
3. Wide dynamic range progressive scan camera able to give a usable picture when viewing a scene with extreme bright and dark content simultaneously.
4. Able to deliver a live view of 24 to 30 images per second at one megabit of bandwidth using H.264 compression allowing more useable images per second at a lower bandwidth and enabling a resource savings in both bandwidth and storage space.
5. Indoor and outdoor rated camera with heater, blower, and dehumidifier that is fully supported by power over Ethernet (POE).
6. Vandal rating that addresses both external and internal components with a protective shock absorbing mechanism for the camera.
7. Ability to automatically adjust the recorded resolution of a head shot/image to maximize facial details.
8. Ability to provide mega pixel resolution over the entire lens view.
9. Pan/Tilt/Zoom camera that provides auto-tracking capability
10. Ability to create an instant J-PEG file/snapshot from a live camera view without the need to search the network video recorder.
11. Must allow for an 8 or 16 multi-camera view from a single camera without software and the need to be connected to the network video recorder.
12. Ability to send alerts both locally to the network video recorder and through email in the event that the camera view is altered by moving, blocking, spray painting etc.
13. Ability to automatically stabilize the image when camera is installed in an environment where vibration is likely to occur. (ex. outside on a windy day)
14. Must have SD/SDHC card backup at the camera level along with the ability to buffer the stored video back to a camera compatible network video recorder should a network failure occur.
15. Ability to process video motion detection at the camera level.
16. Cameras must carry a 3 year warranty on parts and labor.
17. Network video recorder must have a separate processor to allow the processing of large numbers of cameras with video motion detection for consistent error free playback.
18. Network video recorder must allow the registering and recording of up to 64 cameras in H.264 or M-PEG4 with no camera license fees.

19. Network video recorder software/firmware upgrades shall not have a fee and be available via the internet.
20. Network video recorder shall have the ability to “hot swap” hard drives and be expandable from 9 terabytes to 54 terabytes
21. Network video recorder shall use industry standard and recognized hard drives for storage and also carry a 3 year warranty.

1.1 SCOPE OF WORK

A. Furnish and install all equipment accessories and materials in accordance with these specifications to provide a complete and operational system. The Electronic Video Surveillance System shall include bot not be limited to Network Video Recorder, IP Cameras, Housings and Power Supplies.

1.2 RELATED WORK/SECTIONS

A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:
   1. Division 1.
   2. All other Division 280000 sections.

B. See section on Substitutions.

1.3 WORK INCLUDED

A. The contractor shall furnish all equipment, accessories, and material required for the installation of a comprehensive IP Video System 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.

B. The IP Video System shall bear the label of a Nationally Recognized Testing Laboratory (NRTL) such as E.T.L., D.S.&G., or UL and be listed by their re-examination service. All work must be completed in strict accordance with all applicable electrical codes, including N.E.C. Section 800-51 (i), under direction of a qualified and factory approved distributor, to the approval of the Owner.

C. The system is to be designed and configured for maximum ease of service and repair. All major components of the system shall be designed as a standard component of IP Camera Systems.

1.4 SUBMITTALS

A. Submit catalog cuts, layout drawings, diagrams, and calculations for approval in accordance with Section 280000, GENERAL PROVISIONS.

B. Shop Drawings: Submit accurately scaled (1/8"=1'0") layout drawings of system components and accessories. Layout drawings, diagrams and calculations shall be completed by the manufacturer and presented in CAD format. Manual drafting is not acceptable.

C. Include an elevation (front) view of each equipment rack and applicable backboard locations denoting the equipment to be installed, pertinent termination and numbering information, and labeling instructions.

D. The specific item proposed and its area of application shall be marked on the catalog cuts.

E. Wiring Diagrams: Submit interconnection wiring diagrams for systems including connection diagrams. Clearly differentiate between portions of wiring that are manufacturer installed and portions that are field installed.

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.

B. Within thirty-five (35) calendar days after the date of award of the contract, the contractor shall submit to the Architect for review, eight (8) copies of a complete submission. The submission shall consist of five (5) major sections, with each section separated with insert able index tabs. The first section shall be the "Index", which shall include the project title and address, name of the firm submitting the proposal and the name of the Architect. Each page in the submission shall be numbered chronologically and shall be summarized in the index. The second section shall include a copy of the authorized distributor's valid State Contractors License, letters of factory authorization and guaranteed service, list of projects of equal scope and list of proposed instrumentation to be used by the contractor. The third section shall contain the comparative specification listing, including a complete listing of the characteristics of the equipment to be furnished. The fourth section shall contain an original factory data sheet for every piece of equipment in the specifications. The fifth section shall contain a wiring destination schedule for each circuit leaving each piece of equipment.

1.6 QUALIFICATIONS

A. The system shall be supplied by the manufacturer's authorized contractor who is qualified in the proper installation, operation, and service of the system. Certification shall be submitted verifying that the contractor is the manufacturer's authorized. All contractors must be a Panasonic Partner and hold a current i-Pro Certification. Submit proof with your response.

B. Upon request of the Architect/Engineer, the system proposed as an equal shall be made available for demonstration. The demonstration shall be coordinated with the Architect/Engineer and the end-user.

C. Contractor shall attend mandatory job walk.

1.7 EQUIPMENT WARRANTY

A. The contractor shall warrant the equipment to be new and free from defects in material and workmanship, and will, within three years from date of installation, repair or replace any equipment found to be defective. This warranty shall not apply to any equipment that has been subject to misuse, abuse, negligence, accident, or unauthorized modification.

1.8 SERVICE FACILITIES

A. The contractor shall make available, and maintain a satisfactory service department capable of furnishing equipment inspection and service. The contractor shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Panasonic System Solutions Company.

B. Provide High Performance Network Disk Recorder for Panasonic i-Pro Network Cameras.

2.01 HIGH PERFORMANCE NETWORK DISK RECORDER FOR PANASONIC I-PRO NETWORK CAMERAS

A. The WJ-ND400 recorder shall be capable of connecting to up to 64 network cameras without extra license fees and their images can be recorded simultaneously.

B. The recorder shall be equipped with 9 hot plug HDD slots. It shall allow up to 27TB HDD storage to be installed in the main unit. The WJND400 recorder shall have the capability of expansion up to 162 TB with five optional WJ-HDE400 Hard Disk Extension Units, each with 9 HDD slots.

C. The recorder shall support the following Panasonic i-Pro Network Cameras:

- WV-SF438
- WV-SF458
- WV-SF538
- WV-SFV611L

D. The recorder shall have Intelligent VMD search function that allow motions in a specified area in the recorded images of the compatible i-Pro cameras* to be quickly searched.

E. The recorder shall be the equipment with an embedded real-time operating system and shall not be based on a Microsoft Windows OS. The OS must reside completely in the hardware and not be installed on the hard disk drives. Installed disk drives must be dedicated to recording videos.

F. The recorder shall support MPEG-4 and JPEG multi format.

G. The recorder shall provide Various Recording Mode: Manual, Schedule, Event (Pre/Post), Emergency, and External Timer. It shall have the capabilities to control: Pan/Tilt, Zoom, Focus, Brightness and Preset Positions. It shall be able to search using: Time & Date, Event Type and Camera number.

H. The recorder shall have up to 8 recording programs including individual recording mode for each camera, and 6 time schedules per day.

I. The recorder shall have up to 64 audio capabilities and can be recorded and played back at G.726 (ADPCM) 32 kbps.

J. The recorder shall have various alarm sources such as 32x Terminal inputs, 64x Camera alarm, Panasonic Alarm Protocol. The alarm actions shall include Alarm recording, E-mail notification, Alarm message, Camera positioning, FTP image transfer, Terminal output, Panasonic alarm protocol output, Buzzer and LED.

K. The recorder shall have 2x built-in Gigabit network interfaces (10Base-T / 100Base-TX / 1000Base-T) for camera recording and client access.

L. The recorder shall have the quick discovery and IP setup function for Panasonic i-Pro network cameras.

M. The recorder shall have the capabilities to transfer recorded images to FTP server upon alarm and/or live image periodically. Images recorded in the SD memory card in the i-Pro network cameras can be transferred to the recorder automatically even when the recorder is in recording status.

N. The recorder shall have User/Host authentication, 4 programmable user levels, 16 user priorities and User-Camera View/Control partitioning setup for sophisticated user management. It shall be capable of up to 32 user registrations.

O. The recorder shall have Alteration detection and recorded data encryption for data security.

P. Multi recorder, Multi site systems shall be connected with the optional WV-ASM100 i-Pro Management Software.

Q. The recorder shall have RAID5/6 redundant recording for data security. The RAID6 feature allows the recorder to recover from a two-disk failure without any loss of data (minimum four HDDs are required). With hot plug support, drives can be replaced without any downtime, allowing 24/7 operations. It shall have Disk partitioning to include Normal, Event, Pre-Event and Copy for flexible record management.

R. The recorder shall be viewable from any properly connected PC using Microsoft Internet Explorer version 6.0 or later

S. The recorder shall provide user authentication and support different user privileges based on logon ID. From the client the user should (with proper authentication) be able to do the following:

- Setup cameras
- Define live viewing, recording rates and quality settings
- Define recording programs and schedules
- View live video in either single or quad views
- Search and playback recorded video
- Download selected recorded video
- Control connected PTZ cameras

T. The recorder shall work with the optional viewer software WV-ASM200 which is capable of viewing multiple cameras from multiple recorders on a single screen and provide the following features:

- Software shall be able to manage up to 100 networks connected ND300s, ND400s and/or HD300A recorders.
- Software shall be able to display live video from any camera on any connected recorder.
- Software shall be able to display 1, 2x2, 3x3 or 4x4 multiplexed video.
- Software shall show registered recorders as icons in a drop down menu. Cameras will be shown as icons on the same menu, indented under the attached recorder.
- Software shall enable user to assign any video from any recorder into any window on the multiplexed display
- Software shall permit to register up to 32 users and each password and provide up to 5 different levels of user privileges.
- Software shall permit the remote operation of properly configured PTZ cameras according to the user privilege level.
- Software shall provide search functions for registered recorders and allow search by Event, Mark or Motion. It must apply these search criteria across multiple recorders.
- Software shall permit the simultaneous playback of up to 16 videos.
- Software must run on an IBM-PC/AT compatible computer with the following minimum specifications:

1. OS: Microsoft Windows XP Home SP2/ XP Professional SP2/ 32bit Vista Ultimate.
2. CPU: Intel Core 2 Duo 2.66 GHz or faster
3. RAM: 1 GB or more
4. VRAM: 64 MB or more
5. Microsoft DirectX 9.0c or later
6. Graphics Card supporting more than 1024 x 768 resolution
7. 100/1000 Ethernet Network Card
8. Internet Explorer 6.0 SP2 or later
9. Mouse, Keyboard, 1x USB port

U. Supported protocols: TCP/IP, UDP/IP, HTTP, FTP, SMTP, DHCP, DNS, DDNS, NTP, SNMP.

V. The power source shall be 120VAC, 60Hz at approx. 170W.

2.03 CAMERAS

A. Provide the following Cameras based on application. (Choose cameras to include based on applications)

1. Interior standard 360 Degree Cameras shall be Model WV-SF438 with double panorama, panorama, quad PTZ or Single PTZ Viewing modes. 3.1 megapixel, progressive scan.
2. Interior Vandal Resistant 360 Degree Cameras shall be Model WV-SF458 with double panorama, panorama, quad PTZ or Single PTZ Viewing modes. 3.1 megapixel, progressive scan.
3. Interior Standard Dome Camera shall be model WV-SF538 with progressive scan, day night feature, adaptive black stretch, 2.8-10 mm vari-focal lens. 3.1 megapixel.
4. Interior or Exterior Vandal Resistant Dome Camera shall be model WV-SFV611L with progressive scan, day night feature, IR LED Light, super Dynamic, adaptive black stretch, 2.8-10 mm vari-focal lens. 3.1 megapixel. Exterior or Interior locations that require a wall mount shall use a PWM484S bracket.
5. All cameras shall be provided with SDHC cards installed and configured to allow for back up recording in the event of a network failure and the card shall buffer the event s back to the recorder when network is reestablished.

2.4 CABLE

A. Cable for cameras will be installed by Division 27 contractor. This 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 division of actual work listed following shall occur.

B. The conduit, outlets, terminal cabinets, etc., which form part of the rough-in work shall be furnished and installed completely by the electrical contractor. The entire responsibility of the system, its operation, function, testing and complete maintenance for three (3) years after final acceptance of the project by the owner, shall also be the responsibility of the manufacturer's authorized representative.

3.2 EQUIPMENT MANUFACTURER'S REPRESENTATIVE:

A. All work described herein to be done by the manufacturer's authorized representative shall be provided by a documented factory authorized representative of the basic line of equipment to be utilized.

B. As further qualification for bidding and participating in the work under this specification the manufacturer's representative shall hold a valid NC Low Voltage Contractor's License issued by the Contractor's State License Board of North Carolina and a valid NC Alarm License. The manufacturer's representative shall have completed at least ten (10) projects of equal scope, giving satisfactory performance and have been in the business of furnishing and installing IP Camera Systems of this type for at least five (5) years. The manufacturer's representative shall be capable of being bonded to assure the owner of performance and satisfactory service during the guarantee period.

C. The manufacturer's representative shall provide a letter with submittals 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.

D. The contractor shall furnish a letter from the manufacturer of the equipment, which certifies that the equipment has been installed according to factory intended practices, that all the components used in the system are compatible and that all new portions of the systems are operating satisfactorily. Further, the contractor shall furnish a written unconditional guarantee, guaranteeing all parts and all labor for a period of three (3) years after final acceptance of the project by the owner.

3.3 INSTALLATION:

A. Cabling shall be routed as high as possible and above other building facilities in the path with the least obstructions in the ceiling space while maintaining the separation requirements of TIA/EIA 568B1,2,3, TIA/EIA 569A, and NFPA 70 (NEC). There shall be a minimum distance of three inches between the cable and ceiling grid and cable pathways shall be clear of all possible EMF and RFI interference. Specifically cables shall be at least 2 feet away from all fluorescent lights and other potential EMF sources. Any violations of this shall be corrected at the contractor’s expense. Cables shall not be run parallel with electrical conduits or strapped to them. Cinch plastic cable ties shall not be used during any part of the installation process. All cabling required to support the system shall be terminated in an approved manner and not be “cut back” to the cabling sheath or “wrapped” around the cabling sheath. Interconnect between the system and the station cabling shall be terminated in a cross connect method.

B. Cabling installed through “holes, cracks, HVAC duct spaces, etc.” is not acceptable and shall be properly sleeved.

C. Cabling shall be installed appropriately within a sleeve when wall penetrations are required. If using an existing sleeve, contractor is responsible for maintaining any fire stopping system and requirements for fill ratio of sleeve. If existing sleeve is not fire stopped, contractor shall notify owner for direction or install the appropriate sleeve for the installation of the contractor’s cable.

D. Cable Identification:

1. 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.

E. Splicing:

1. Splicing of cables is not permitted between terminations.

F. Wall and Floor Penetrations:

1. All penetrations through floors and walls shall be sleeved. All sleeves shall have permanently installed bushings.
3. Sleeves shall be sized to accept 50% growth.
4. All sleeves shall installed per manufacturer's instructions and shall protrude 3 inches on each side of the penetration.
5. Sleeves through floors shall be supported with conduit riser clamp.
6. Existing sleeves can be used with the following exceptions:
   a. Use of any sleeve containing emergency signaling cable is prohibited
   b. Using any sleeve, when doing so would exceed 40% fill ratio, is prohibited.

G. Fire stopping:

1. Fire stopping material shall be installed inside all riser conduit sleeves to form smoke barriers after installation of the cabling is completed. Malleable foam-type bricks cut to fit should be used where possible (Hilti FS-fire block, or equal). Intumescent putty shall be used in an UL approved assembly when fire bricks are not feasible.

H. Cable Installation:

1. Do not pull wire or cable through any box fitting or enclosure where change of raceway alignment or direction occurs; do not bend conductors to less than recommended radius. Employ temporary guides, sheaves, rollers, and other necessary items to protect cables from excess tension, abrasion, or damaging bending during installation. Care shall be taken not to bend, crush or kink cables.
2. All cable shall be installed in a complete, neat, and orderly fashion. Cables shall not be twisted or have any damage to the cable jacket.
3. Cables shall be installed parallel or at 90 degree angles to the building walls. Diagonal, beeline, or non-supported cable routing is unacceptable.

I. Equipment Cabinets or Racks:

1. Comb straight and form in a neat and orderly manner all conductors located within equipment cabinets in the head end room or remote locations, and wiring harnesses in the head end room. Tie as required using Velcro cable ties of appropriate type and size.
2. Service Loops:
   a. Provide 10 foot service loops at each termination so that plates, panels, and equipment can be dismounted for service and inspection.

J. Plug disconnect: All major equipment components shall be fully pluggable by means of multi-pin receptacles and matching plugs to provide for ease of maintenance and service.

K. Protection of cables: Cables within terminal cabinets, equipment racks, etc., shall be grouped and bundled (harnessed) as to type and laced with No. 12 cord waxed linen lacing twine or Velcro. Edge protection material ("cat-track") shall be installed on edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edge.

L. Cable identification: Cable conductors shall be color-coded and individual cables shall be individually identified. Each cable identification shall be a unique number located

approximately 1-1/2" from cable connection at both ends of cable. Numbers shall be approximately 1/4" in height. These unique numbers shall appear on the As-Built Drawings provided by the installer and these drawings shall be mounted in each equipment room used to support any part of the entire system.

3.4 TRAINING:

A. Provide a minimum of eight (8) hours of complete "in service" instructions of system operation to school personnel.

END OF SECTION APPENDIX

SECTION 282300
VIDEO SURVEILLANCE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 DOCUMENT INFORMATION

A. The specifications provided in the Appendix that follows are provided FOR REFERENCE as New Hanover County School System Standard Specifications. These specifications are provided in their entirety as received from New Hanover County School System. Inclusion here is not intended to represent that these specification sections are the work of Cheatham and Associates, P.A. Contact the Engineer for clarification of conflicts that may arise by inclusion of these specifications.

1.03 CONTENT

A. New Hanover County School System Standard Specifications:

1. Section 282300A, Electronic Video Surveillance.

1.04 DEVIATIONS, ADDITIONS, DELETIONS FROM STANDARD SPECIFICATIONS

A. Add 1.4.F. 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. Add 1.4.G. 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.

C. Modify 2.01.A. Axis, Bosch, Panasonic, and Pelco.

D. Add 2.01.C. Panasonic I-Pro Series components will be bid as a Preferred Alternate. Items specified by specific manufacturer and model number include:

1. System: Panasonic I-Pro Series.
2. High Performance Network Disk Recorder: Panasonic #WJ-ND400.
3. Network Cameras: Panasonic #WV-SF438, WV-SF458, WV-SF538, WV-SF611L.
4. View Software: Panasonic #WV-ASM2000.

END OF SECTION

SECTION 284621.11

ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Device guards.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.
11. System Printer

1.03 DEFINITIONS

A. EMT: Electrical Metallic Tubing.

B. FACP: Fire Alarm Control Panel.

C. HLI: High Level Interface.

D. NICET: National Institute for Certification in Engineering Technologies.

E. PC: Personal computer.

F. VESDA: Very Early Smoke-Detection Apparatus.

1.04 SUBMITTALS

A. Product Data: For each type of product, including furnished options and accessories.

1. Include construction details, material descriptions, dimensions, profiles, and finishes.
2. Include rated capacities, operating characteristics, and electrical characteristics.

B. Shop Drawings: For fire-alarm system.

1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
2. Include plans, elevations, sections, details, and attachments to other work.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes,

indicate termination locations and requirements, and distinguish between factory and field wiring.

4. Detail assembly and support requirements.
5. Include voltage drop calculations for notification-appliance circuits.
6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.

    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Show field wiring required for HVAC unit shutdown on alarm.
    c. Locate detectors according to manufacturer's written recommendations.

13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:

    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified, fire-alarm technician; Level III minimum.
    c. Licensed or certified by authorities having jurisdiction.

D. Submit under provisions of the General and Supplemental General Conditions and Division 1 Specifications Sections.

E. Submittals shall demonstrate compliance with technical requirements by reference to each subsection of this specification.

F. Product Data: Provide electrical characteristics and connection requirements, and provide mA draw for each device submitted and the listed minimum voltage required to operate. Panel submittal shall list voltage drop allowed for panel and for individual NAC circuits.

G. The fire alarm contractor shall submit complete Shop Drawings to the Architect/Engineer for review, prior to performing any work. They shall clearly demonstrate compliance with the Architect/Engineer’s Drawings and specifications, which have a System Response Matrix showing the fire alarm system's actions (outputs) required for each type of alarm, supervisory, and trouble signal. Any non-compliant features shall be fully described.

H. The submitted shop drawings shall show equipment, device identification numbers and locations, and connecting wiring of entire fire alarm system. Include wiring and riser diagrams. Wiring diagrams shall be based on the project floor plans, with devices and proposed conduit routing. The conductor composition for each conduit section shall be provided. The distance and route for each NAC (Notification Appliance Circuit) shall be shown. Riser diagrams shall show consecutive

connections for all devices with addresses and candela and candela ratings. Provide detailed battery and communications amplifier(s) capacity calculations.

I. Architect/Engineer's approval (with or without comments) of contractor's Shop Drawings, samples, cut sheets, etc., is for general conformance with the contract documents and design concept. It shall not relieve the contractor of responsibility for full compliance with the project plans and specifications, EXCEPT for any specific non-compliant features for which the Architect/Engineer gives written authorization.

J. Installation Instructions: The contractor shall submit to the Architect/Engineer the manufacturer's detailed installation instruction for the Fire Alarm Control Panel and all duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.

K. Battery Calculations:
1. Include a copy of system battery sizing calculations with the shop drawing submittal to the Architect/Engineer. Use manufacturer's battery discharge curve to determine expected battery voltage after 60 hours of providing standby power. Then use calculated Notification Appliance Circuit current draw in the alarm mode to determine expected voltage drop at End of the Line Resistor (EOL), based on conductor resistance per manufacturer's data sheet or NEC.
2. Fire Alarm Vendor's calculations shall be submitted with the shop drawings, and prior to installation of equipment. In the submittal package identify Notification Appliance Circuits (NAC) current draws and voltage drops for each circuit. In no case shall the calculated voltage at any notification appliance fall below the minimum listed operating voltage for the devices used.
3. The voltage drop at EOL shall not exceed 14% of the expected battery voltage, after the required standby time plus alarm time. (Typically, for a 24 volt system, this limits the voltage drop from the battery to the EOL to 3 volts). Determine "worst case" voltage at far end of each NAC, by subtracting its calculated V-drop from the expected battery voltage. The result shall be no less than the minimum listed operating voltage for the alarm notification appliances used.
4. All of these calculations shall be placed on a dedicated sheet of as-built drawings, for future reference by fire alarm service technicians. NAC voltage drop is to be verified during system tests.

L. Maintenance Data: The contractor shall submit maintenance data and parts lists for each type of fire alarm equipment installed, including furnished specialties and accessories. This data, product data, and shop drawings shall be included in the maintenance manual.

M. Certifications: Submit a certification from the major equipment manufacturer indicating that the proposed supervisor of installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses, and telephone numbers in the certification. The installing contractor's technicians shall hold current (within previous 24 months) certifications issued by the manufacturer. These certifications shall be submitted to the Architect/Engineer prior to installation showing name, photo identification, date of training and date of certification.

N. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and commissioning of products.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
d. Riser diagram.
e. Device addresses.
f. Air-sampling system sample port locations and modeling program report showing layout meets performance criteria.
g. Record copy of site-specific software.
h. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:

    1) Equipment tested.
    2) Frequency of testing of installed components.
    3) Frequency of inspection of installed components.
    4) Requirements and recommendations related to results of maintenance.
    5) Manufacturer's user training manuals.

i. Manufacturer's required maintenance related to system warranty requirements.
j. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.06 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
3. Smoke Detectors, Heat Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

1.08 PROJECT CONDITIONS

A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.

B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Owner no fewer than seven days in advance of proposed interruption of fire-alarm service.
2. Do not proceed with interruption of fire-alarm service without Owner's written permission.

C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.09 SEQUENCING AND SCHEDULING

A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.

1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
2. Warranty Period: One year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Notifier (Preferred Alternate) NFS2-3030 system must be compatible with the existing Sea-Tech system.

2.02 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Duct smoke detectors.
5. Carbon monoxide detectors.
6. Automatic sprinkler system water flow.

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation notices.
2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
8. Record events in the system memory.
9. Record events by the system printer.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.

D. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal ac voltage at fire-alarm control unit.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.

E. System Supervisory Signal Actions:

1. Initiate notification appliances.
2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.

2.03 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.

   a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
   b. Include a real-time clock for time annotation of events on the event recorder and printer.
   c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
   d. The FACP shall be listed for connection to a central-station signaling system service.
   e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.

2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.

C. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:

1. Pathway Class Designations: NFPA 72, Class A.
2. Pathway Survivability: Level 1.
3. Install no more than 100 addressable devices on each signaling-line circuit.
4. Serial Interfaces:

a. One dedicated RS 485 port for central-station operation using point ID DACT.
b. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
c. One RS 232 port for PC configuration.
d. One RS 232 port for voice evacuation interface.

D. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

E. Notification-Appliance Circuit:

1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.

F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall **be** connected to fire-alarm system.

G. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.

a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
b. Programmable tone and message sequence selection.
c. Standard digitally recorded messages for "Evacuation" and "All Clear."
d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.
3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

J. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.

L. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed Gel-cell type with expected life of 10 years.

M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.04 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. 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.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.

2.05 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V dc, nominal.
2. Detectors shall be two-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
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.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
7. Remote Control: Unless otherwise indicated, detectors shall be digital-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.

    a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
    b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
    c. Multiple levels of detection sensitivity for each sensor.
    d. Sensitivity levels based on time of day.

B. Photoelectric Smoke Detectors:

1. 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.
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.).

C. Ionization Smoke Detector:

1. 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.
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.).

2.06 CARBON MONOXIDE DETECTORS

A. General: Carbon monoxide detector listed for connection to fire-alarm system.

1. Mounting: Adapter plate for outlet box mounting.

2. Testable by introducing test carbon monoxide into the sensing cell.
3. Detector shall provide alarm contacts and trouble contacts.
4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
5. Comply with UL 2075.
6. Locate, mount, and wire according to manufacturer's written instructions.
7. Provide means for addressable connection to fire-alarm system.
8. Test button simulates an alarm condition.

2.07 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

1. Temperature sensors shall test for and communicate the sensitivity range of the device.

B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.

1. Mounting:Twist-lock base interchangeable with smoke-detector bases.
2. 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 190 deg F (88 deg C).

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.08 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.

1. Rated Light Output:
   a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, **red**.

D. Voice/Tone Notification Appliances:

1. Comply with UL 1480.

2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
3. High-Range Units: Rated 2 to 15 W.
4. Low-Range Units: Rated 1 to 2 W.
5. Mounting: surface mounted and bidirectional.
6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.09 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.
4. Rating: 120-V ac.

B. Material and Finish: Match door hardware.

2.10 REMOTE ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Surface cabinet, NEMA 250, Type 1.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.11 ADDRESSABLE INTERFACE DEVICE

A. General:

1. Include address-setting means on the module.
2. Store an internal identifying code for control panel use to identify the module type.
3. Listed for controlling HVAC fan motor controllers.

B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.

C. Integral Relay: Capable of providing a direct signal to circuit-breaker shunt trip for power shutdown.

1. Allow the control panel to switch the relay contacts on command.
2. Have a minimum of two normally open and two normally closed contacts available for field wiring.

D. Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

2.12 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.
8. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 DEVICE GUARDS

A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.

1. Factory fabricated and furnished by device manufacturer.
2. Finish: Paint of color to match the protected device.

2.14 SURGE PROTECTION

A. The following protection against voltage transients and surges shall be provided by the fire alarm equipment supplier, and installed by the electrical contractor:
1. On AC Input: A feed-through (not shunt-type) branch circuit transient suppressor such as Leviton 51020-WM-DN, or Di-Tech DTK-120S20A, or equivalent UL 1449 - 2nd Edition Listed device.
2. On DC Circuits Extending Outside Building: Adjacent to the FACP, and also near point of entry to outlying building, provide "pi"-type filter on each leg, consisting of a primary arrestor, series impedance, and a fast acting secondary arrestor that clamps at 30v-40v. Some acceptable models: Simplex 2081-9027, Simplex 2081-9028, Transtector TSP8601, Ditek DTK 2MHLP24B series, Citel America B280-24V, and Northern Technologies DLP-42. Submit data on others to

the Architect/Engineer for approval. UL 497B listing is normally a prerequisite for their consideration. Devices using only MOV active elements are not acceptable.

2.15 WIRING

A. Addressable loop (signaling line) circuits shall be wired with type FPL/FPLR/FPLP fire alarm cable, AWG 18 minimum, low capacitance, twisted shielded copper pair. Cable shield drain wires are to be connected at each device on the loop to maintain continuity, taped to insulate from ground, and terminated at the FACP. Acceptable cables include Atlas 228-18-1-1STP, BSCC S1802s19 (same as EEC 7806LC), West Penn D975, D991 (AWG 16), D995 (AWG 14), or equal wire having capacitance of 30pf/ft. maximum between conductors. Belden 5320FJ acceptable if only FPL rating needed. The cable jacket color shall be red, with red (+) and black (-) conductor insulation.

B. Unshielded cable, otherwise equal to the above, is permitted to be used if the manufacturer's installation manual requires, or states preference for, unshielded cable.

C. In underground conduit, Type TC or PLTC cable (PE insulated) shall be used to avoid problems from moisture.

2.16 TERMINAL CABINETS

A. Terminal cabinets shall be sheet steel, hinged cover type not less than 10” x 16” x 10” deep. Cabinets shall conform to Specs Section 260534 and shall be labeled in accordance with Specs Section 260553.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EQUIPMENT INSTALLATION

A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.

C. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.

D. Smoke- or Heat-Detector Spacing:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
3. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
4. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.

F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.

G. Air-Sampling Smoke Detectors: If using multiple pipe runs, the runs shall be pneumatically balanced.

H. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

I. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.

J. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.

L. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.03 SURGE PROTECTION

A. For each AC power circuit that interfaces with fire alarm equipment install an AC suppressor in a listed enclosure near the electrical panelboard, and trim excess lead lengths. Wind small coil in the branch circuit conductor just downstream of the suppressor connection. Coil to be 5 to 10 turns, about 1" diameter, and securely tie-wrapped. This series impedance shall improve the effectiveness of the suppressor in clipping fast rise time voltage transients.

B. On DC Circuits Extending Outside Building: Install the surge arrestor in a labeled enclosure near the point of entry to or exit from each building.

3.04 AC POWER

A. Switching to emergency power during alarm shall not cause signal drop-out. Batteries shall meet the appropriate NFPA capacity requirements, with a 25% safety factor. This requirement is in effect even if generator power is supplied to the Fire Alarm Control Panel.

B. The branch circuit breaker(s) supplying the system shall be physically protected by panelboard lock or handle lock and each shall be identified with a 1/4" permanent red dot applied to handle or exposed body area.

C. Provide an engraved label at each fire alarm system control unit, system sub-panel or data gathering panel, supplementary notification appliance (SNAC) panel, digital alarm communicator, etc.

D. The fire alarm system shall monitor 120vac power to shunt trip breakers used in conjunction with fire suppression systems. Examples include a shunt trip used for cooking appliance power shut-off when the kitchen hood fire suppression system is activated, or primary elevator power shut-down upon sprinkler flow in any elevator equipment space or shaft. Use an addressable monitor module to accomplish this supervisory function.

3.05 CONDUIT AND WIRING

A. The exterior of all junction boxes containing fire alarm conductors shall be painted red; box interiors shall not be painted. Box covers for junction boxes containing fire alarm conductors shall be painted red on both sides.

B. Box covers shall be labeled to indicate the circuit(s) or function of the conductors contained therein. Labels shall be neatly applied black lettering on a clear background. Handwritten labels or labels made from embossed tape are not acceptable.

C. All fire alarm system wiring shall be in metal conduit or surface metal raceway. All fire alarm system raceway, couplers, and connectors shall meet the performance and installation requirements of Electrical Specification Section "RACEWAYS".

D. If cable size and the requirement to maintain a Class "A" loop on all Signaling Line Circuits cause conduit fill to exceed specified maximums for the 1/2" size; 3/4" raceway shall be used.

E. All conduits that penetrate outside walls from air conditioned space shall have internal sealing (duct-seal), to prevent condensation from infiltrating humid air.

F. All wiring shall be color coded All the circuits in the system shall be wired with AWG 14, minimum, stranded copper, THHN/THWN conductor, installed in metallic conduits. Color Coded wires shall be in accordance with the following scheme, which shall be maintained throughout the system, without color change in any wire run;

1.	Initiating Circuits, general	Red (+)/White (-)
2.	Initiating Circuits, smoke only	Violet (+)/Gray (-)
3.	Signal Line Circuit cable	Red jacket with Red(+)/Black(-)
4.	Alarm Indicating Appliance Circuits	Blue (+)/Black (-)
5.	AHU Shutdown Circuits	Yellow (+)/Brown (-)
6.	Door Control Circuits	Orange
7.	Elevator Capture Circuits	Brown

G. To minimize wiring fault impact, isolation modules shall be provided in all of the locations listed below. If ceiling height ≤10 feet, isolator base type initiating devices are permitted to be used to satisfy any or all of the following:

1. In or immediately adjacent to the FACP, at each end of the addressable loop. These two isolators shall be in the same room and within 15 feet of the FACP.

2. After each 20 initiating devices and control points on the addressable loop, or a lesser number where recommended by the manufacturer. (Check instructions.)
3. For loops with 20 devices and control points, install an isolator at the approximate middle of the loop (in addition to those at the FACP.
4. Near the point any addressable circuit extends outside the building, except for those attached to the building exterior walls and well sheltered by walkways.
5. For loops covering more than one floor, install isolator at terminal cabinet on each floor (with additional isolator[s] on any floor with over 20 addresses).
6. Each isolation module shall be clearly labeled, readily accessible for convenient inspection (not above a lay-in ceiling), and shown on as-built drawings.

H. Detection or alarm circuits shall not be included in raceways containing AC power or AC control wiring. Within the FACP, any 120 VAC control wiring or other circuits with an externally supplied AC/DC voltage above the nominal 24 VDC system power shall be properly separated from other circuits and the enclosure shall have an appropriate warning label to alert service personnel to the potential hazard.

I. Style 6 Circuits Required: Systems with one or more addressable sub-panels that (1) have an integral addressable loop controller, or (2) monitor multiple non-addressable initiation zones, shall comply with the NFPA 72 requirements for Style 6 circuits.

J. There shall be no splices in the system other than at device terminal blocks, or on terminal blocks in cabinets. "Wire nuts" and crimp splices shall not be permitted. Permanent wire markers shall be used to identify all connections at the FACP and other control equipment, at power supplies, and in terminal cabinets. All terminal block screws shall have pressure wire connectors of the self lifting or box-lug type.

K. All wiring shall be checked for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum resistance to ground or between any two conductors shall be ten (10) megohms, as verified with a megger. Provide advance notice to the Architect/Engineer of these tests.

L. The system shall be electrically supervised for open or (+/-) ground fault conditions in SLC, alarm circuits, and control circuits. Removal of any detection device, alarm appliance, plug-in relay, system module, or standby battery connection shall also result in a trouble signal. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.

3.06 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Magnetically held-open doors.
2. Supervisory connections at valve supervisory switches.

3.07 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 270553 "Identification for Communications Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.08 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.09 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.10 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within one years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 1**0** days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.11 AIR HANDLER UNIT (AHU) SHUTDOWN

A. A supervised "AHU Shutdown Defeat" switch shall be provided in/adjacent to the FACP or as a key-operated function in the Remote Annunciator (if provided). If the FAA option is utilized, provide an informative engraved label at the FACP about this function. The switch shall cause a system "trouble" indication when it's placed in the off-normal ("Shutdown Defeated") position. This is to provide the Owner with a convenient means to temporarily resume HVAC operation in the event an unwanted alarm shall not clear, prior to arrival of the fire alarm service technician.

B. If the system includes AHU shutdown or smoke removal startup, silencing the alarm (without resetting) shall not reverse the shutdown. A supervised "AHU Shutdown Defeat" switch shall be provided in the FACP. The switch shall be labeled and its "Normal" position indicated. Provide supervised Hand-Off-Auto switch(es) at the FACP for any building smoke control equipment (pressurization or exhaust fans).

3.12 ANNUNCIATOR

A. Each addressable fire alarm system shall include an LED-type "zone" annunciator at (or in) the FACP, or in another location if acceptable to the AHJ. As a minimum, this annunciator shall indicate

the specific type of alarm or supervisory signal (smoke detector, water-flow, sprinkler valve closed, etc.), for groups of addressable devices. The area ("zone") that is represented by each LED shall not exceed 1 floor or 22,500 square feet, and shall not cross building fire walls or smoke compartments.

1. Systems in 1 or 2-story buildings, which have 30 or fewer initiating devices, are permitted to omit the LED-type "zone" annunciator.
2. Systems with a Graphic Annunciator (GA) are permitted to omit the LED-type "zone" annunciator.
3. The LED annunciator is permitted to be omitted if the FACP has a multi-line display that automatically defaults to displaying the first alarm, plus the first 3 (minimum) water-flow alarms and the last alarm. This is permitted to be done using 2 automatically alternating screens. If there is no sprinkler system, program the FACP to show the first 4 alarms plus the last alarm received.

3.13 ALARM VERIFICATION FOR SMOKE DETECTORS

A. The fire alarm system shall be equipped with Alarm Verification.

B. System shall provide as a feature an alternate signal processing algorithm to verify the presence of smoke. The algorithm shall be selectable during system programming. The total effective delay created by the verification algorithm shall not exceed 60 seconds.

3.14 REMOTE ALARM TRANSMISSION REQUIREMENTS

A. Each system with automatic fire detection, or which monitors a sprinkler system, shall be equipped with a 4-channel (minimum) Digital Alarm Communicator Transmitter (DACT) for transmission of fire alarm, supervisory, and trouble signals to a Central Station, Remote Supervising Station, or Proprietary Supervising Station. DACT shall be dual line type in accordance with NFPA 72.

B. As applicable the following signals shall be reported:
   1. Fire Alarm
   2. Fire Alarm System AC Power Trouble (only if 120vac interrupted for 1 to 8 hours)

C. In lieu of a DACT, the use of an addressable network is acceptable. Other appropriate means of transmitting fire alarm system signals off-premises may be permitted to be used, at the discretion of the AHJ who approves the plans.

D. The Contractor shall provide a type of DACT that is compatible with the owner's alarm receiving equipment, or the Supervising Station selected by the owner, as applicable. He shall also program the PROM, connect each DACT to the telephone line(s) provided to him, and verify proper signal receipt by the Supervising Station. The transmission means shall comply with NFPA 72 (which does not permit VOIP).
   1. See NFPA 72 for means of transmission requirements. It permits the phone line(s) to be shared, since the DACT can capture a line that's busy if needed. However, PBX station circuits are not permitted to be used. Contact the AHJ if VOIP, cellular, derived local channel, or RF technology is intended for the reporting means
   2. Where leased or dedicated lines are available back to the Owner's security station provide a polarity reversal type alarm module. Polarity reversal type alarm modules report only Alarm, Line Trouble, and OK conditions.

3.15 AUTOMATIC SMOKE DOOR AND AUTOMATIC LOCK REQUIREMENTS

A. Wall-mounted magnetic door holders and separate heavy-duty closers shall be used, instead of combination door control units. The electromagnets shall be controlled by the building's smoke detection system FACP. Individual smoke detector auxiliary contacts shall not be used to release door holders.

B. Automatic door locks controlled by the system shall be either fail safe magnetic locks or fail-safe electro-mechanical with reverse bevel dead bolts.

C. All locked protected doors shall immediately unlock upon fire alarm, loss of AC power, disablement of the fire alarm system (defined as loss of 24 VDC power) or upon manual operation of an unlock switch at a constantly attended location.

3.16 SPRINKLER SYSTEM MONITORING

A. The following sprinkler system alarm and supervisory functions shall be provided as a part of the fire alarm system:
   1. Water-flow alarm, by sprinkler zone (not to exceed one floor).
   2. Supervision of each control valve.

B. Sprinkler supervisory monitoring of flow switches, tamper switches, and similar functions shall be accomplished with a separate system address for each activity monitored.

3.17 KITCHEN EXHAUST HOOD EXTINGUISHING SYSTEMS

A. Installation shall comply with the current edition of NFPA 72 Standard for the type of system installed.

B. System(s) shall be interconnected with the fire alarm system as a separate system address.

C. The exhaust fan shall continue running after the system has been discharged, (except on carbon dioxide systems) to remove smoke; the supply fan should stop. All sources of heat for appliances served by the extinguishing system (both electric and/or gas) shall be turned off.

3.18 FIRE ALARM SYSTEM INSTALLATION AND CONFIGURATION

A. Supervision required: The connection between individual addressable modules and their contact type initiating device(s) shall be supervised. Where indicated on the Drawings, a Graphic Annunciator (GA) with separate Light Emitting Diodes (LED) indication for each alarm and supervisory signal initiating device shall be included. Multiple initiating devices of the same type within a single room may be permitted to share a common LED. The GA shall show all major building features such as corridors, elevators, stairs, exits, and "YOU ARE HERE". GA layout shall be submitted for approval.

B. Graphic Chart shall be mounted behind Plexiglass and secured to surface. Mounting shall be such that charts cannot be removed without a flat head screw driver.

C. Floor Plans with Device Numbers: A copy of the floor plans shall be provided in the control panel. A separate sheet shall be provided for each floor. Plans shall be reduced in size from engineering plans in order to fit on 11 x 14 sheets. All device addresses shall be clearly labeled on plans. Indicate locations of all cabinets, modules and end of line device. Plans shall be bound in book form. Sheets shall be laminated. Provide legend for symbols. Provide holder for plan book in panel or in a locked box adjacent to panel keyed to match panel. Provide label for box and book.

D. Loop 1 shall be assigned to the first floor devices and loop number shall increase with floor number. Device numbering starts in the same location on each floor and increase accordingly as circuit location increases.

3.19 FIRE AND LIFE SAFETY CRITERIA FOR DOORS CONTROLLED BY FIRE ALARM SYSTEM

A. Exit or exit access doors that are locked to delay egress, in accordance with the NC Building Code:

1. These doors shall immediately unlock upon any fire alarm signal, loss of building AC power, disablement of the fire alarm system (defined as loss of its 24vdc power), or upon manual operation of an unlock switch at a constantly attended location.
2. Where installed on smoke or fire doors, power failure shall cause these mechanisms to default to the egress mode with normal mechanical latching; this is to assure the smoke or fire doors continue to perform their vital function in a power failure situation, instead of swinging open and allowing the passage of smoke and fire between compartments.
3. Smoke doors are permitted to be held open by 24vdc wall/floor-mounted magnets powered by the FACP, and released upon alarm. The resulting current drain shall be included in the standby battery calculations or the system shall be programmed to drop the door hold-open magnet load 60 seconds after the loss of 120vac power

B. Contact the AHJ for guidance on programming the fire alarm system to determine which fire alarm initiation devices should cause release of these doors. The customary setup is to have this done for selected smoke detector and/or water-flow alarm in adjacent spaces, rather than upon general alarm, to minimize the potential disruption of possible nuisance alarms in remote parts of the building. The FACP should have an appropriate information placard regarding this function, to avoid nuisance drops during routine system maintenance operations.

3.20 SYSTEM DOCUMENTATION, TRAINING AND MAINTENANCE

A. Maintenance: The manufacturer, or authorized distributor, shall maintain software version records on the system installed. The system software shall be upgraded free of any charge if a new VER is released during the warranty period. For new VER to correct operating problems, free upgrade shall apply during the entire life of the system.

B. System Report in addition to the Shop Drawing submittal described elsewhere, the fire alarm system contractor shall provide the Architect/Engineer two bound copies of the following technical information, for transmittal to the owner:
1. As-Built wiring diagram showing all loop numbers and device addresses, plus terminal numbers where they connect to control equipment.
2. As-built wiring and conduit layout diagrams, including wire color code and/or label numbers, and showing all interconnections in the system.
3. Electronic circuit diagrams of all control panels, modules, annunciators, communications panels, etc.
4. Manufacturer's detailed maintenance requirement.
5. Technical literature on all control equipment, isolation modules, power supplies, batteries, detectors, manual stations, alarm/supervisory signal initiating devices, alarm notification appliances, relays, remote alarm transmission means, etc.
6. The as-built "calculations" sheet.

C. Electronic archive: Complete configuration data (site-specific programming) for the system shall be stored on electronic media and archived by the fire alarm system manufacturer or authorized distributor. A diskette or CD copy of this data shall be submitted to the Architect/Engineer for transmission to the owner on the day the system is commissioned. The contractor shall provide the owner with one copy of the following:
1. All software required, both for the installed fire alarm system and personal computer (PC) necessary to access the fire alarm system for trouble shooting, programming, modifications, monitoring, de-bugging, or similar functions, (if Owner does not have the needed PC to check the system).
2. Complete documentation for all software for both the installed fire alarm system and for any interface PC software necessary for system functions as described above.
3. Framed floor plans, mounted at the FACP. Plans shall show all system devices with the unique device identification numbers indicated adjacent to each device. The identification numbers shall match those represented in the as-built drawings and those reported at the FACP and the LCD annunciator.

4. Interconnection cable where such is required to connect the fire alarm system to a PC; (if Owner does not have the needed PC to check the system).

D. Training; the manufacturer's authorized representative shall instruct the owner's designated employees in operation of the system, and in all required periodic maintenance. Two copies of a written, bound summary shall be provided, for future reference.
   1. Some facilities maintain their own systems and require more in-depth training. Check to verify needs and requirements.
   2. Scheduling of training shall be arranged to meet the Owner's schedule. Additional training shall be available at a cost to be mutually agreed upon by the Owner and the Contractor.
   3. Training shall be in the Owner's provided classroom.
   4. The training may not be waived, deleted or reduced in the number of hours required.
   5. Training shall cover as minimum the following topics:
      a. Preventive maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
      b. Overall system concepts, capabilities, and functions. Training shall be in depth, so that the owner shall be able to take any device out of service and return any device to service without need of Manufacture's approval or assistance.
      c. Explanation of all control functions, including training to program and operate the system software.
      d. Methods and means of troubleshooting and replacement of all field wiring devices.
      e. Methods and procedures for troubleshooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry and interconnections.
      f. Manuals, drawings, and technical documentation. Actual system software used for training shall be provided in digital form and shall be left with the Owner at the completion of training for the Owner's use in the future.
      g. The owner shall be trained to perform all NFPA 72 required maintenance. The training shall include both demonstration and supervision of a "hands-on" replacement of heads. Panel modifications required to take detector heads out of service and return them to service shall be "hands-on" training session. The training shall be in a minimum of two 4-hour sessions provided on separate days. The schedule shall be coordinated with the owner. A written competency test shall be submitted to the Architect/Engineer and to the owner as a sample prior to using the written competency test at the site. A written description of a hands-on test shall be provided to the Architect/Engineer and owner for review prior to using the test at the site. As a minimum the following tests shall occur during certification of the owner's employee:
         1) Three smoke heads shall be taken offline at the panel and removed physically.
         2) Three smoke heads shall be reinstalled and returned to service at the fire alarm panel.
         3) The vendor shall provide three dirty smoke detector heads to be installed at various positions in the building. The owner shall print a sensitivity report and the employees shall find the "dirty" smoke detector heads by reviewing the sensitivity report.
         4) A ground fault and an isolation problem shall be introduced by the vendor into the system. The employees shall then find the ground fault and the isolation problem.
         5) An NFPA 72 "Record of Completion" form shall be provided and the employees shall fill out the forms which shall be checked by the vendor for proper use of the form.
         6) The written testing for how to perform services on a panel shall be given during the last 4 hour session with the employees.
         7) The vendors shall witness the owner's "trained" employees, train other employees and correct any mistakes made during the training session. This is expected to occur during the 2nd four hour session.

3.21 SPARE PARTS

A. The following spare parts shall be provided with the system. For multi-building projects, calculate quantities separately for each building that contains a dedicated fire alarm control panel. If FACP

also serves auxiliary buildings (e.g., storage, boiler/chiller), calculate as if one building. Increase decimal quantities to the next higher whole number:

1. Fuses (If Used)..... 2 of each size in system
2. Manual Fire Alarm Boxes..... 2% of installed quantity
3. Addressable Control Relays..... 4% of installed quantity
4. Indoor Horns/Speakers with Strobes Lights..... 4% of installed quantity
5. Indoor Strobe-only Notification Appliances..... 4% of installed quantity
6. Monitor Modules (Addressable Interface)..... 4% of installed quantity
7. Isolation Modules / Isolation Bases.....4% of installed quantity
8. Addressable, Electronic Heat Detectors..... 4% of installed quantity
9. Spot-Type Smoke Detectors / Sounder Bases…..... 6% of installed quantity
10. No spares are required for projected beam, air sampling, or duct smoke detectors.

3.22 SYSTEM TESTING AND CERTIFICATION

A. Upon completion of the installation the Contractor and the Manufacturer's authorized installer together shall conduct a 100% performance test of each and every alarm initiating device for proper response. The system shall operate for 48 hours prior to start of test. The Contractor shall be present for the full 100% test.

B. The A/E and owner shall be given 7 days advance notice of the tests. All Audio Visual Device Testing shall be scheduled with the owner.

C. 100% Test: The manufacturer or authorized distributor (by definition, "installer") shall 100% test all site-specific software functions for the system and then provide a detailed report or check list showing the system's operational matrix. This documentation shall be part of the "System Status and Programming Report".

1. Upon completion of the installation and its programming, the installer's technician shall test every alarm initiating device for proper response and indication, and all alarm notification appliances for effectiveness. Also, in coordination with the other building system contractors, all other system functions shall be verified, including (where applicable) elevator capture and the control of HVAC systems, door locks, pressurization fans, fire or smoke doors/dampers/shutters, etc. The Architect/Engineer shall be notified in advance of these 100% tests, to permit witnessing them if desired.
2. If AHU shutdown occurs for any alarm, then the matrix would indicate the specific control relay(s) for that function being commanded to operate for alarm from any initiating device. If a rolling steel fire door is to drop only upon water-flow alarm from its sprinkler zone, or upon any two spot smoke detectors in adjacent spaces being simultaneously in alarm, the matrix would show the door's control relay activating upon alarm from the applicable water-flow switch(es), or from any two smoke detectors in the selected spaces (AND gate)
3. The Digital communicator shall be on-line tested for proper communication to the receiving station.
4. All supervised circuits shall also be tested to verify proper supervision. (Control circuits and remote annunciation lines are among those required to be supervised.)
5. All testing described above shall be repeated in the event that subsequent software or wiring modifications are determined necessary to meet the requirements of the contract documents. Such re-testing shall be included as part of the base bid and provided at no additional cost to the Owner.
6. Test Documentation: The installer shall fill out and submit the following documentation to the owner, through the Architect/Engineer, prior to the AHJ's system acceptance inspection:
   a. Written verification that this 100% system test was done with copy of print out generated during test.
   b. The NFPA 72, "Record of Completion" Form. Use this form (no substitutes) to detail the system installation and also to certify that: (a.) It was done per Code, and (b.) The Code-required 100% test was performed. The fire alarm installer (manufacturer or authorized distributor's technician) shall sign this form. If a representative of the AHJ, owner, or

Architect/Engineer witnesses the tests, in whole or in part, they shall also sign the form to signify that fact only (annotating the form as needed to clarify their limited role).

c. For buildings with a smoke control or smoke purge system, an HVAC balance report, in the smoke control / smoke purge mode.

d. The System Status and Programming Report described in NFPA 72. This shall be generated on the day of the system acceptance inspection and shall include the measured sensitivity of each smoke detector.

e. The purpose of doing Item (d) on the day of the inspection is to assure detector sensitivity has not been affected by construction dust. Prudent contractors shall have taken measures to prevent detector contamination during construction, and shall also have had the system do a detector sensitivity test and printout prior to the day of the inspection, to make certain all devices are properly programmed and operating within their limits.

7. After completion of the 100% system test and submission of documentation as described above the installer is to request the Architect/Engineer to set up an inspection. The system shall operate for at least two days prior to this inspection. The responding Fire Department shall be notified of this, for pre-fire planning purposes. On local government projects, local fire authorities may also want to participate in system acceptance inspections. However, for State-owned property they have no inspection jurisdiction and, if present, are only to observe.

3.23 PRE-FINAL AND FINAL INSPECTION

A. Pre-Final Inspection: At the Owner's request and after passing the Designer's pre-final inspection, the Contractor and Manufacturer's authorized installer shall conduct system test in the presence of the Owner and the Designer.

B. Final Inspection: The fire alarm system shall be inspected, with portions of it functionally tested. This shall normally include the use of appropriate means to simulate smoke for testing detectors, as well as functionally testing the system interface with building controls, fire extinguishing systems and any off-premises supervising station. Operation of any smoke removal system shall be checked as instructed by the AHJ. This statistical (sampling) inspection is intended to assure that the contractor has properly installed the system and performed the 100% operational test as required by NFPA 72. The electrical contractor shall provide two-way radios, ladders, and any other materials needed for testing the system, including a suitable smoke source.

C. The test shall be conducted entirely by the Contractor. A copy of the final database software shall be presented to the Owner before this test. The software shall be loaded from these disks into the system in the presence of the Owner. The review shall then be conducted using this software. Any deficiencies shall be recorded and corrected. After the items have been corrected, the system shall be tested again.

1. In the event of malfunctions or excessive nuisance alarms, the Contractor shall take prompt corrective action. The Owner may require a repeat of the Contractor's 100% system test, or other inspections.
2. Test Report: Upon successful completion of the Inspection and after the correction of all efficiencies, the manufacturer's authorized representative shall issue a test report to the Architect/Engineer and Owner, detailing and certifying the test.
3. System Acceptance: After successful completion of the Final Inspection and recommendation of the Architect/Engineer, the system shall be accepted by the Owner. At this time the warranty period begins.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Clearing and protection of vegetation.
B. Removal of existing debris.

1.02 RELATED SECTIONS

A. Section 01 11 00 - Summary: Limitations on Contractor's use of site and premises.
B. Section 01 11 00 - Summary: Sequencing and staging requirements.
C. Section 31 25 00 - Temporary Erosion and Sedimentation Control.
D. Section 01 73 00 - Execution: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.
E. Section 31 22 00 - Grading: Topsoil removal.
F. Section 31 22 00 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
G. Section 31 23 23 - Fill and Backfill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.
H. Section 31 23 23 - Fill and Backfill: Filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCES

1.04 SUBMITTALS

A. See Section 01 33 00 – Submittal Procedures, for submittal procedures.
B. Erosion Control Plan: Showing:
   1. Vegetation removal limits.
   2. Areas for temporary construction and field offices.

1.05 QUALITY ASSURANCE

A. Clearing Firm: Company specializing in the type of work required.
   1. Minimum of five years of documented experience.

1.06 PROJECT CONDITIONS

A. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
B. Comply with other requirements specified in Section 01 73 00.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fill Material: As specified in Section 31 22 00 – Grading

PART 3 - EXECUTION

3.01 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
B. Protect existing utilities to remain from damage.
C. Do not disrupt public utilities without permit from authority having jurisdiction.
D. Protect existing structures and other elements that are not to be removed.

3.02 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.
B. Do not begin clearing until vegetation to be relocated has been removed.
C. Do not remove or damage vegetation beyond the following limits:
   1. 40 feet (12 m) outside the building perimeter.
   2. 10 feet (3.1 m) each side of surface walkways, patios, surface parking, and utility lines less than 12 inches (305 mm) in diameter.
   3. 15 feet (4.6 m) each side of roadway curbs and main utility trenches.
   4. 25 feet (7.5 m) outside perimeter of pervious paving areas that must not be compacted by construction traffic.
   5. Exception: Specific trees and vegetation indicated on drawings to be removed.
   6. Exception: Selective thinning of undergrowth specified elsewhere.

D. Install substantial, highly visible fences at least 3 feet (1 m) high to prevent inadvertent damage to vegetation to remain:
   1. At vegetation removal limits.
   2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
   3. Around other vegetation to remain within vegetation removal limits.
   4. See Section 01 50 00 for fence construction requirements.

E. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.
F. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; preference should be given to on-site uses.
   2. Trees: Sell if marketable; if not, treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches (450 mm).
   3. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches (450 mm).
   4. Sod: Re-use on site if possible; otherwise sell if marketable, and if not, treat as specified for other vegetation removed.
   5. Fill holes left by removal of stumps and roots, using suitable fill material, with top

surface neat in appearance and smooth enough not to constitute a hazard to pedestrians.

G. Dead Wood: Remove all dead trees (standing or down), limbs, and dry brush on entire site; treat as specified for vegetation removed.
H. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.03 DEBRIS

A. Remove debris, junk, and trash from site.
B. Leave site in clean condition, ready for subsequent work.
C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 31 10 00

SECTION 31 22 00
GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Removal of topsoil.
B. Rough grading and preparation of site for site structures, building pads, and drainage features.
C. Finish grading.

1.02 RELATED SECTIONS

A. Section 31 10 00 - Site Clearing.
B. Section 31 23 00 - Excavation.
C. Section 31 23 23 - Fill and Backfill: Filling and compaction.
D. Section 31 23 33 - Trenching for Site Utilities: Trenching and backfilling for utilities.
E. Section 32 92 19 - Seeding: Finish ground cover.
F. Section 32 92 23 - Sodding: Finish ground cover.

1.03 UNIT PRICES

A. See Section 01 22 00 - Unit Prices, for general requirements relating to unit prices for this work.
B. Topsoil: Applies to Unit Price.
   1. Measurement Method: By the square yard down to a drawing-defined elevation.
   2. Includes: Excavating existing topsoil, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.04 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of North Carolina, Highway Department standards.
   1. Maintain one copy on site.

1.06 PROJECT CONDITIONS

A. Protect above- and below-grade utilities that remain.
B. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.
C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fill Materials: See Section 31 23 23.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.
B. Stake and flag locations of known utilities.
C. Locate, identify, and protect utilities that remain, from damage.
D. Notify utility company to remove and relocate utilities.

3.03 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
B. Do not remove topsoil when wet.
C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.
E. When excavating through roots, perform work by hand and cut roots with sharp axe.
F. See Section 31 23 23 for filling procedures.
G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.
H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.04 SOIL REMOVAL

A. Stockpile excavated topsoil on site.
B. Stockpile topsoil to be re-used on site; remove remainder from site.
C. Remove excavated topsoil from site.
D. Stockpile excavated subsoil on site.
E. Stockpile subsoil to be re-used on site; remove remainder from site.
F. Remove excavated subsoil from site.
G. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet (2.5 m); protect from erosion.

3.05 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.
B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove soil contaminated with petroleum products.
C. Where topsoil is to be placed, scarify surface to depth of 3 inches (75 mm).

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).
E. Place topsoil in areas where seeding are indicated.
F. Place topsoil where required to level finish grade.
G. Place topsoil to the following compacted thicknesses:
   1. Areas to be Seeded with Grass: 6 inches (150 mm).
   2. Areas to be Sodded: 4 inches (100 mm).
   3. Shrub Beds: 18 inches (450 mm).
   4. Flower Beds: 12 inches (300 mm).
   5. Planter Boxes: To within 3 inches (75 mm) of box rim.
H. Place topsoil during dry weather.
I. Remove roots, weeds, rocks, and foreign material while spreading.
J. Near plants spread topsoil manually to prevent damage.
K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
L. Lightly compact placed topsoil.

3.06 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot (30 mm) from required elevation.
B. Top Surface of Finish Grade: Plus or minus 1/2 inch (13 mm).

3.07 FIELD QUALITY CONTROL

A. See Section 31 20 30 for compaction density testing.

3.08 CLEANING AND PROTECTION

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.
B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 31 22 00

SECTION 31 22 16
SUBGRADE AND ROADBED

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and provisions of the General Conditions, Supplemental Conditions, and Division 1 are included as part of this Section as though bound herein.
B. Section 500 of the North Carolina Department of Transportation "Standard Specifications for Roads and Structures" dated July 2006.

1.02 WORK INCLUDED

A. The work covered by this section consists of the preparation, shaping, and compaction of that portion of the roadway areas that are to be paved.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

A. Preparation of Subgrade:
   1. The subgrade shall be shaped to the lines, grades, spot elevations and typical sections shown on the plans. Where the Owner's Representative directs that areas of the subgrade are to be stabilized, the subgrade in such areas may be left uniformly below grade to provide for the addition of the stabilizer material.
   2. All unsuitable material, boulders, and all vegetative matter shall be removed and replaced with suitable material. Suitable material, when not available from the subgrade work, shall be taken from pond excavation or borrow sources.
   3. Material excavated in preparing the subgrade shall be stored or stockpiled in such a manner as to not interfere with proper drainage or any of the subsequent operations of placing aggregate base course.

B. Compaction of Subgrade:
   1. When tested, all material to a depth of 12 inches below the finished surface of the subgrade shall be compacted to a density equal to at least 100% of that obtained by compacting a sample of the material in accordance with ASTM D 698.
   2. The subgrade shall be compacted at a moisture content which is approximately that required to produce the maximum density indicated by the above test method. The Contractor shall dry or add moisture to the subgrade when required to provide a uniformly compacted and acceptable subgrade.

3.02 TOLERANCES

A. A tolerance of plus or minus 1/2 inch from the established grade will be permitted after the subgrade has been graded to a uniform surface.

3.03 PROTECTION OF SUBGRADE

A. Ditches and drains shall be provided and maintained when required to satisfactorily drain the subgrade. Where previously approved subgrade is damaged by natural causes, by hauling equipment, or by other traffic, the Contractor shall restore the subgrade to the required lines, grades, and typical sections and to the required density at no cost to the Owner.

END OF SECTION 31 22 16

SECTION 31 23 00
EXCAVATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, site structures, and utilities within the building.
B. Trenching for utilities outside the building to utility main connections.

1.02 RELATED SECTIONS

A. Section 01 78 00 - Execution Requirements: General requirements for dewatering of excavations and water control.
B. Section 31 22 00 - Grading: Soil removal from surface of site.
C. Section 31 22 00 - Grading: Grading.
D. Section 31 23 23 - Fill and Backfill: Fill materials, filling, and compacting.
E. Section 31 23 33 - Trenching for Site Utilities: Excavating for utility trenches outside the building to utility main connections.
F. Section 31 37 00 - Riprap.
G. Section 33 46 00 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 UNIT PRICES

A. See Section 01 22 00 - Unit Prices, for general requirements applicable to unit prices for excavation.
B. Unit Price: Excavating Soil Materials:
   1. Measurement method: By the cubic foot.
   2. Includes: Excavating to required elevations, loading and placing materials in stockpile.
   3. Does Not Include Over-Excavation: Payment will not be made for over-excavated work nor for replacement materials.
C. See Section 31 23 23 - Fill and Backfill, for measurement and payment provisions related to fill.

1.04 PROJECT CONDITIONS

A. Verify that survey bench mark and intended elevations for the Work are as indicated.
B. Protect plants, lawns, rock outcroppings, and other features to remain.
C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

PART 2 - PRODUCTS - NOT USED

PART 3 – EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours, and datum locations.
B. See Section 31 22 00 for additional requirements.

3.02 EXCAVATING

A. Underpin adjacent structures which may be damaged by excavating work.
B. Excavate to accommodate new structures and construction operations.
C. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
D. Preparation for Piling Work: Excavate to working elevations. Coordinate special requirements for piling.
E. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.
F. Do not interfere with 45 degree bearing splay of foundations.
G. Cut utility trenches wide enough to allow inspection of installed utilities.
H. Hand trim excavations. Remove loose matter.
I. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.
J. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23.
K. Grade top perimeter of excavation to prevent surface water from draining into excavation.
L. Remove excavated material that is unsuitable for re-use from site.
M. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.
N. Remove excess excavated material from site.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 – Quality Requirements, for general requirements for field inspection and testing.
B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.04 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.
B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION 31 23 00

SECTION 31 23 23
FILL AND BACKFILL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Filling, backfilling, and compacting for building volume below grade.
B. Backfilling and compacting for utilities outside the building to utility main connections.
C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.02 RELATED SECTIONS

A. Section 31 22 00 - Grading: Removal and handling of soil to be re-used.
B. Section 31 22 00 - Grading: Site grading.
C. Section 31 23 00 - Excavation: Removal and handling of soil to be re-used.
D. Section 31 23 33 - Trenching for Site Utilities: Excavating for utility trenches outside the building to utility main connections.
E. Section 31 37 00 - Riprap.
F. Section 33 46 00 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.
G. Section 03 30 00 - Cast-in-Place Concrete.

1.03 UNIT PRICES

A. See Section 01 22 00 - Unit Prices, for general requirements applicable to unit prices for earthwork.

1.04 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18 in. Drop; American Association of State Highway and Transportation Officials; 2001 (2004).
B. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
C. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3); 2000a.
D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.
E. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3); 2002.
F. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994(R 2001).
G. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.
H. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth); 2005.
I. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
J. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of

Soils; 2005.

1.05 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.
B. Subgrade Elevations: 4 inches below finish grade elevations indicated on drawings, unless otherwise indicated.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
C. Compaction Density Test Reports.

1.07 PROJECT CONDITIONS

A. Provide sufficient quantities of fill to meet project schedule and requirements. When necessary, store materials on site in advance of need.
B. When fill materials need to be stored on site, locate stockpiles where indicated.
1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination.
3. Protect stockpiles from erosion and deterioration of materials.
C. Verify that survey bench marks and intended elevations for the Work are as indicated.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

A. Materials shall conform to the respective specifications and other requirements specified below.
   1. Granular Material: Shall conform to the gradation requirements of ASTM D 693 size No. 67.
   2. Stone Bedding: Shall conform to Class I, 1/4 inch to 1 1/2 inch graded stone bedding, as described in ASTM D 2321.
   3. Portland Cement Concrete: Shall conform to ASTM C-94, with a 28-day compressive strength of 3,000 pounds per square inch. Concrete shall be protected from freezing and moisture loss for 7 days.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Identify required lines, levels, contours, and datum locations.

3.02 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots.
B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 BACKFILLING

A. Except for special materials for pavements, the remainder of the trench shall be backfilled with ASTM 2487 Class I, II, III or IV material that is free of stones larger than 6 inches in any dimension or one-half the layered thickness, whichever is smaller. Each layer shall be compacted to not less than the minimum density specified as applicable to the particular area per Section 31 20 10 - Site Grading, of these specifications. Equipment for compacting backfill in trenches and excavation shall be especially selected for the type of material used in the backfill. Generally, vibrating type equipment shall be utilized for non-cohesive soils and impact type equipment shall be used for cohesive soils.
B. Excavated Space: For manholes, wet wells, piers and similar structures shall be free of all debris prior to placing backfill. Remove all concrete forms. Place backfill in 8-inch thick layers and thoroughly compact each layer with mechanical tampers as necessary to prevent subsequent settlement. Extend backfill to indicated finish grade.
C. Equipment shall not be allowed to pass over pipe until 3 feet of compacted cover has been placed over the pipe.

3.04 EXCESS WATER CONTROL

A. General: Grade and maintain all areas of the site to preclude surface runoff into excavations and prevent ponding of water.
B. Dewatering: Excavations should be kept free of surface water and/or groundwater. Provide and maintain at all times the necessary means and devices to prevent water from entering the excavations and for removing all water entering the excavations.
C. Softened Subgrade: Remove all soil softened or eroded by the presence of water and replace with suitable backfill material.

3.05 TOLERANCES

A. Top Surface of General Filling: Plus or minus 1 inch from required elevations.
B. Top Surface of Filling Under Paved Areas: Plus or minus 1 inch from required elevations.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, ASTM D2922, or ASTM D3017.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor"), ASTM D 1557 ("modified Proctor"), or AASHTO T 180.
D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.07 CLEAN-UP

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION 31 23 23

SECTION 31 23 23.23
PROOF ROLLING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and provisions of the General Conditions, Supplemental Conditions, and Division 1 are included as part of this Section as though bound herein.
B. Section 260 of the North Carolina Department of Transportation "Standard Specification for Roads and Structures" dated July 2006.

1.02 WORK INCLUDED

A. The work covered by this section consists of the Contractor furnishing and operating heavy pneumatic tired compaction equipment for compacting and testing the roadway areas for stability and uniformity of compaction.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. The equipment shall consist of 4 rubber-tired wheels mounted on a rigid steel frame. The wheels shall be evenly spaced in one line across the width of the roller and shall be arranged in such a manner that all wheels will carry approximately equal loads when operated over an uneven surface. The maximum center-to-center spacing between adjacent wheels shall not exceed 32 inches. The compacting equipment shall have a suitable body for ballast loading with such capacity that the gross load shall be from 48 to 50 tons unless otherwise permitted by the Owner's Representative in writing. Other equipment of equal of better effectiveness may be substituted with written permission from the Owner's Representative.
B. The tires shall be operated at inflation pressures between 68 to 72 pounds per square inch unless otherwise permitted by the Owner's Representative in writing. The tires shall be inflated with air only; no liquid shall be used.
C. Ballast to obtain the weight directed by the Owner's Representative shall consist of bulk, sand, bulk stone, bags of sand, stone, or other materials of known unit weight such that the total weight of the ballast used can be readily determined at all times. There shall be a sufficient amount of ballast available to load the equipment to a maximum gross weight of 50 tons. The loaded roller shall be so constructed that it will not trap water that will add weight to the ballast.
D. Rubber tired or other types of tractive equipment may be used for operation of this equipment on the roadbed. The entire assembly including motivating equipment shall be capable of executing a 180-degree turn on a 27-foot wide area.

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

A. After the roadway areas have been completed to within 0.50 foot of final grade, these areas shall then be compacted and tested with one coverage, unless otherwise directed by the Owner's Representative, of a heavy pneumatic tired roller meeting the equipment requirements. A coverage is considered that state in the rolling procedure when the entire width of the area being proof rolled has been in contact with the pneumatic tires of the roller. The roller shall be operated in a systematic manner so that the number of coverages over all areas to be proof rolled can be readily determined and recorded.

B. The equipment shall be operated at a speed between 225 and 300 feet per minute.

C. Proof rolling shall be done only in the presence of the Owner's Representative.

D. If it becomes necessary to take corrective action, such as but not limited to underdrain installation, undercut and backfill of unsuitable material, and aeration of excessively wet material in areas that have been proof rolled, these areas shall be proof rolled again following the completion of the necessary corrections.

END OF SECTION 31 23 23.23

SECTION 31 3116
TERMITE CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Vapor barrier placement under concrete slab-on-grade.

1.03 REFERENCE STANDARDS

A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2019.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.

C. Test Reports: Indicate regulatory agency approval reports when required.

D. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate caution requirement and application instructions.

F. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three (3) years of documented experience.

G. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing this type of work and:
   1. Having minimum of three (3) years documented experience.
   2. Licensed in the State in which the Project is located.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 CHEMICAL SOIL TREATMENT

A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.

B. Diluent: Recommended by toxicant manufacturer.

C. Mixes: Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.

B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

A. Comply with requirements of U.S. EPA and applicable state and local codes.

B. Spray apply toxicant in accordance with manufacturer's instructions.

C. Apply toxicant at following locations:
   1. Under Slabs-on-Grade.
   2. At Both Sides of Foundation Surface.

D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.

E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.

F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.

G. Re-treat disturbed treated soil with same toxicant as original treatment.

H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

A. Do not permit soil grading over treated work.

END OF SECTION 31 3116

SECTION 32 11 23
AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.
B. Paving aggregates.

1.02 RELATED SECTIONS

A. Section 31 22 00 - Grading: Preparation of site for base course.
B. Section 31 23 23 - Fill and Backfill: Compacted fill under base course.
C. Section 31 23 33 - Trenching for Site Utilities: Compacted fill over utility trenches under base course.
D. Section 33 49 13 - Manholes and Covers: Manholes including frames.
E. Section 32 11 26 - Bituminous Concrete Paving: Binder and finish asphalt courses.
F. Section 31 23 23 - Fill and Backfill: Topsoil fill at areas adjacent to aggregate base course.

1.03 UNIT PRICES

A. See Section 01 20 00 - Unit Prices, for general requirements applicable to unit prices for earthwork.
B. Coarse Aggregate Type C: By the cubic yard. Includes supplying aggregate material, stockpiling, scarifying substrate surface, placing, and compacting.
C. Fine Aggregate Type B: By the cubic yard. Includes supplying aggregate material, stockpiling, scarifying substrate surface, placing where required, and compacting.

1.04 REFERENCES

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; American Association of State Highway and Transportation Officials; 1965 (2004).
B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 10-lb Rammer and a 18 in. Drop; American Association of State Highway and Transportation Officials; 2001 (2004).
C. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2006.
D. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3); 2000a.
E. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method; 2000.
F. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3); 2002.
G. ASTM D 2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 1994(R 2001).
H. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2000.
I. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by

Nuclear Methods (Shallow Depth); 2005.

J. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
K. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2005.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
C. Compaction Density Test Reports.

1.06 PROJECT CONDITIONS

A. Provide sufficient quantities of aggregate to meet project schedule and requirements. When necessary, store materials on site in advance of need.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General Requirements: Aggregate base course material shall consist of crushed stone, crushed or uncrushed gravel or other similar material having hard, strong, durable, particle free of adherent coatings and comply with the gradation requirements contained in Section 520 of the NCDOT "Standard Specifications for Roads and Structures" referenced above.

2.02 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.
B. Where aggregate materials are specified using ASTM D 2487 classification, test and analyze samples for compliance before delivery to site.
C. If tests indicate materials do not meet specified requirements, change material and retest.
D. Provide materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.02 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

A. The subgrade shall be prepared as called for on the plans in accordance with Section 31 22 16 of these specifications prior to placement of the base material.

B. The aggregate material shall be placed on the subgrade with a mechanical spreader capable of placing the material to a uniform loose depth without segregation except that for areas inaccessible to a mechanical spreader, the aggregate material may be placed by other methods approved by the Owner's Representative.
C. Where the required compacted thickness of base is 8 inches or less, the base material may be spread and compacted in one layer. Where the required compacted thickness is more than 8 inches, the base material shall be spread and compacted in 2 or more approximately equal layers. The minimum compacted thickness of any one layer shall be approximately 4 inches.
D. Each layer of material shall have been sampled, tested, compacted and approved prior to placing succeeding layers of base material or pavement.
E. No base material shall be placed on frozen subgrade or base.
F. No traffic shall be allowed on the completed base course other than necessary local traffic and that developing from the operation of essential construction equipment as may be authorized by the Owner's Representative. Any defects that develop in the completed base or any damage caused by local or construction traffic shall be acceptably repaired at no cost to the Owner.
G. The Contractor shall utilize methods of handling, hauling and placing which will minimize segregation and contamination. If segregation occurs, the Owner's Representative may require that changes be made in the Contractor's methods to minimize segregation, and may also require mixing on the roadway areas which may be necessary to correct any segregation. No additional compensation will be allowed for the work of mixing as may be required under this provision. Aggregate that is contaminated with foreign materials to the extent that the base course will not adequately serve its intended use will be removed and replaced by the Contractor at no additional cost to the Owner.

3.04 SHAPING AND COMPACTING

A. Within 48 hours after beginning the placing of a layer of the base, the Contractor shall begin machining and compacting of the layer. Each layer shall be maintained to the required cross section during compaction and each layer be compacted to the required density prior to placing the next layer.
B. Each layer of the base shall be compacted to a density equal to at least 100% of that obtained by compacting a sample of the material in accordance with AASHTO T180.
C. The base material shall be compacted at a moisture content which is approximately that required to produce a maximum density indicated by the above test method. The Contractor shall dry or add moisture to the material when required to provide a uniformly compacted and acceptable base.
D. The final layer of base material shall be shaped to conform to the lines, grades and typical sections shown on the plans or established by the Owner's Representative. When completed, the base course shall be smooth, hard, dense, unyielding and well bonded. A broom drag may be used in connection with the final finishing and conditioning of the surface of the base course.
E. After final shaping and compacting of the base, the Owner's Representative will check the surface of the base for conformance to the grade and typical section and determine the base thickness.
F. The thickness of the base shall be within a tolerance of plus or minus 0.1 feet of the base thickness required by the plans. The maximum differential between the established grade and the base within any 100-foot section shall be 0.1 feet.
G. Where the base material is placed in a trench section, the Contractor shall provide adequate drainage through the shoulders to protect the subgrade and base until such time as the shoulders

are completed.

H. The Contractor shall maintain the surface of the base by watering, machining, and rolling or dragging when necessary to prevent damage to the base by weather or traffic.
I. Where the base or subgrade is damaged, the Contractor shall repair the damaged area; reshape the base to required lines, grades and typical sections; and recompact the base to the required density at no cost to the Owner.

3.05 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.
B. Scheduled Compacted Thickness: Within 1/4 inch.
C. Variation From Design Elevation: Within 1/2 inch.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556.
C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D 698 ("standard Proctor").
D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.07 CLEAN-UP

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION 32 11 23

SECTION 32 11 26
BITUMINOUS CONCRETE PAVING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aggregate base course.
B. Single course bituminous concrete paving.
C. Double course bituminous concrete paving.
D. Surface sealer.

1.02 RELATED SECTIONS

A. Section 31 22 00 - Grading: Preparation of site for paving and base.
B. Section 31 23 23 - Fill and Backfill: Compacted subgrade for paving.
C. Section 33 49 13 - Manholes and Covers: Manholes, including frames.
D. Section 32 17 23 - Pavement markings.

1.03 UNIT PRICES

A. See Section 01 20 00 - Unit Prices for requirements applicable to this section. Measurement and payment will be as follows:
B. Asphalt Pavement Mix (Base Course): By the ton. Includes preparing base, tack coating surfaces, placing, compacting and rolling, testing. Includes mix design, supplying to site, testing.
C. Asphalt Pavement Mix (Binder Course): By the ton. Includes preparing base, tack coating surfaces, placing, compacting and rolling, testing. Includes mix design, supplying to site, testing.
D. Asphalt Pavement Mix (Wearing Course): By the ton. Includes preparing base, tack coating surfaces, placing, compacting and rolling, testing. Includes mix design, supplying to site, testing.
E. Seal Coat: By the square yard. Includes preparing surfaces and applying.

1.04 REFERENCES

A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; The Asphalt Institute; 1994, Sixth Edition.
B. AI MS-19 - A Basic Asphalt Emulsion Manual; The Asphalt Institute; Third Edition.
C. ASTM D 946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 1982 (Reapproved 2005).

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with State of North Carolina Highways standard.
B. Mixing Plant: Conform to State of North Carolina Highways standard.
C. Obtain materials from same source throughout.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable code for paving work on public property.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Aggregate for Base Course: In accordance with State of North Carolina Highways standards.
B. Aggregate for Binder Course: In accordance with State of North Carolina Highways standards.
C. Aggregate for Wearing Course: In accordance with State of North Carolina Highways standards.
D. Fine Aggregate: In accordance with State of North Carolina Highways standards.
E. Mineral Filler: Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
F. Primer: In accordance with State of North Carolina Highways standards.
G. Tack Coat: Homogeneous, medium curing, liquid asphalt.

2.02 BASE COURSE

A. Earth Type Base Course: If allowed in the scope of this project, shall consist of approved selected soil materials. The material shall consist of topsoil, naturally or artificially proportioned sand-clay, or sand-clay gravel obtained from locations designated or approved by the owner's representative. Earth type base course shall comply with requirements of Section 520 for materials and construction procedures. The earth type base course shall be placed on a prepared sub-grade mixed, shaped, brought to proper moisture content and compacted in accordance with these specifications or as directed by the owner's representative.

B. Stabilized Aggregate Base Course: If allowed in the scope of this project, shall consist of properly graded mixture of natural or crushed gravel or stone, crushed slag, natural or processed sand that will readily compact to required density. Base course shall comply with requirements of Section 520 for materials and construction procedures. Stabilized aggregate base course shall be mixed, placed on a prepared sub-grade, brought to proper moisture content, and shaped. Compacted, and primed in accordance with these specifications or as directed by the owner's representative.

C. Hot Laid Asphalt Aggregate Base Course (Black Base): If allowed in the scope of this project, shall consist of a base course of crushed stone, crushed slag, or gravel and asphalt cement mixed in an approved plant and constructed on a prepared sub-grade.Hot laid asphalt aggregate base course shall comply with requirements of Section 610 for materials and construction procedures.

2.03 TACK COAT

A. Asphalt Emulsion Grade SS01: This grade may be diluted with not more than 50% water.

Note: ss01 shall meet requirements as specified in section 605 of standard specs manual (latest edition) of the North Carolina Department of Transportation.

B. Apply to contract surfaces of previously constructed bituminous concrete or Portland cement concrete and similar surfaces. Distribute at rate of 0.05 to 0.15 gallons per square yard of surface.
C. Apply tack coat by brush to contact surfaces of curbs, gutters, manholes, and other structures projecting into or abutting asphalt concrete pavement.
D. Allow tack coat to dry to proper conditions of tackiness to receive paving before proceeding with work.

2.04 HOT LAID ASPHALTIC CONCRETE SURFACE COURSE

A. Mineral aggregate and asphalt cement shall conform to Section 610 for materials and construction procedures.
B. Aggregate and asphalt cement shall be mixed in an approved plant in such proportions that compositions by weight of finished mixture shall be within range limits as specified in Section 610.
C. The surface course shall be constructed on a prepared base in accordance with these specifications and to the lines, grades, and typical cross section shown on the plans or as directed by owner's representative.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE

A. Place and compact base course.

3.03 PREPARATION - TACK COAT

A. Apply tack coat in accordance with manufacturer's instructions.
B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.
C. Coat surfaces of manhole frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.04 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. Install Work in accordance with State of North Carolina Highways standards.
B. Place asphalt within 24 hours of applying primer or tack coat.
C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
D. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.05 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

A. Place asphalt binder course within 24 hours of applying primer or tack coat.
B. Place wearing course within two hours of placing and compacting binder course.
C. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
D. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.06 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
B. Variation from True Elevation: Within 1/2 inch.

3.07 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.
B. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2.

END OF SECTION 32 11 26

SECTION 32 17 23
PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and provisions of the General Conditions, Supplemental Conditions, and Division 1 are included as part of this Section as though bound here.

1.02 RELATED REQUIREMENTS

A. The General Provisions of Division 1 shall govern this section.
B. Construction drawings.
C. Section 32 11 26 - Bituminous Concrete Paving.

1.03 DESCRIPTION OF WORK

A. Extent of traffic stripe painting is shown on the drawings.
B. All parking stalls, centerline of entrance drives and other markings as shown on the drawings.
C. All handicap symbols, directional arrows, turn symbols, stop and yield symbols, no parking stripping, as required for traffic control, are a part of this specification.
D. All work and materials shall comply with appropriate department of transportation standard specifications, latest edition.

1.04 JOB CONDITIONS

A. Traffic painting shall be applied only when ambient temperature is above 50 degrees F. and when temperature has not been below 35 degrees F. for 12 hours immediately prior to application. Do not apply when pavement is wet, unclean, or damaged.

PART 2 - PRODUCTS

2.01 PAINT

A. Paint shall be "white" traffic stripe suitable for traffic line marking on highways with composition conforming to appropriate department of transportation standard specifications; however, all sections related to pavement shall be excluded.
B. Paint color for fire lanes and for handicap symbols shall be as per local codes. All paint used shall be suitable for traffic line marking and shall conform to appropriate department of transportation standard specifications.

PART 3 - EXECUTION

3.01 PARKING LOT STRIPE PAINTING

A. All parking stalls and centerline striping shall be 4" wide with a wet film thickness of 0.015 inches.
B. The paint shall dry to touch within 15 minutes, shall dry to no pick-up within 30 minutes when tested in accordance with ASTM C-711. The color after drying shall be pure flat white, free from tint, furnishing the maximum amount capacity for both daylight and artificial light.
C. The contractor shall certify via letter to the engineer that the paint and execution of work complies with the appropriate North Carolina Department of Transportation standard specifications.

END OF SECTION 32 17 23

SECTION 32 20 10
CAST-INPLACE CONCRETE

Rev. 1.01

1.01 GENERAL

Concrete shall consist of a mixture of Portland cement aggregates and water, proportioned in accordance with the requirements of this specification. Admixtures shall be included with these primary ingredients only when specifically authorized.

SPECIAL PRECAUTIONS IN FREEZING WEATHER

2.01 FROZEN AGGREGATES

Frozen aggregates or aggregates containing lumps of frozen material shall be thawed before using.

2.02 WORK IN FREEZING WEATHER

When the temperature falls below thirty-two (32) degrees Fahrenheit, all the materials which enter into the construction of concrete work of any kind are to be thoroughly heated and used while hot. This shall be accomplished by heating the aggregates and water with which the concrete is mixed. As soon as the concrete is placed, it is to be protected from frost, either by backfilling or covering with hay, straw or some similar substance, to a depth of at least one (1 ') foot. A covering of canvas or boards will not be sufficient, but where steam is available and it is practical to cover all exposed concrete with canvas and introduce steam under the canvas, it will be deemed a sufficient protection. When the temperature falls to or below thirty-five (35) degrees Fahrenheit, no concrete work of any kind is to be done except by special permission of the Engineer, and then strictly according to his directions. Concrete shall be deposited on frosted or frozen subgrade.

PROPORTIONS AND CONSISTENCY

In proportioning concrete materials one (1) bag (sack) of cement shall be considered as being one (1) cubic foot volume and ninety-four (94) pounds weight.

3.01 AGGREGATES

The weight per unit volume of the aggregates shall be based on dry and rodded weights determined in accordance with ASTM C-29 latest version.

3.02 WATER

Total or maximum water shall be considered as that including added water absorbed (surface) water in the aggregates.

Water shall be measured by volume or weight. The device for the measurement of water shall be readily adjustable under all operating conditions and shall be accurate to one-half (1/2%) percent or less.

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3.03 CEMENT

Cement shall be measured by weight when bulk cement is used and where in batching it is necessary to use a portion of a bag. Otherwise for bag cement, the bag weight of ninety-four (94) pounds may be used. Cement shall not be weighed in the same batch box as the aggregates, but a separate scale shall be used.

3.04 ADMIXTURES

Powdered admixtures shall be measured by weight and liquid admixtures by weight or volume.

3.05 WEIGHING HOPPERS & SCALES

Scales utilized in proportioning shall be either springless dial, multiple beam type, or solid-state digital strain gauge transducer type. Scale gradations shall be no greater than:

Aggregate Scales	30 lbs.
Cement Scales	6 lbs.
Water Scales	6 lbs.

All scale indicators shall be enclosed against moisture and dust. Weighing equipment shall be insulated against vibration and movement of other operating equipment in the plant. When the entire plant is running, the scale reading at cut-off shall not vary more than I% for cement, I% for water, I 1/2% for any size of aggregate, nor I% for the total aggregate in any batch.

3.06 CONSISTENCY

The consistency of the concrete shall be determined by the slump test, hereinafter referred to, and said mixes shall be of the consistency required by the Engineer; but the ratio of fine aggregate to total aggregate shall be maintained as shown in Table 1.

MIXING AND DELIVERY

All concrete under this specification shall be machine mixed, where the volume to be placed is equal to or greater than (I) cubic yard. Hand mixing may be allowed where the volume to be placed is less than (l) cubic yard.

4.01 MIXERS

Mixers shall be stationary or truck mixers and shall conform with ASTM C-94 latest revision. The mixer drum shall be of adequate size to accommodate the maximum batch and shall be rotated at the rate specified by the manufacturer. The mixer shall be equipped with an automatic timing device to prevent discharge of the concrete until the specified mixing time has elapsed. In lieu of an automatic timing device, the Contractor may elect to use a stop watch in the hands of a reliable worker.

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4.02 MIXING TIME

The minimum mixing time for batches of one (1) cubic yard capacity or less shall be one (1) minute; for larger capacity of mixes this mixing time shall be increased at the rate of one-half (~)minute for each cubic yard or fraction thereof additional capacity.

The mixing time shall be measured from the time that all of the materials and one-half (1/2) of the water are in the drum. The water shall not be added faster than consuming ten (10) complete drum revolutions.

4.03 CENTRAL PLANT READY MIX CONCRETE DELIVERY

Central Plant Ready Mix Concrete shall be delivered to the work site at the specified consistency in watertight containers in which segregation will not take place and from which the concrete can be discharged freely.

4.03.1 Delivery Period
Central Plant Ready Mix Concrete shall be delivered to the work site and pouring begun within a period of one and one half (1 ~) hours after the introduction of mixing the water to the dry materials.

4.03.2 Cold Weather Delivery
Concrete delivered in out of door temperature lower than forty (40) degrees shall arrive at the work having a temperature of not less than sixty (60) degrees F., nor greater than one hundred (100) degrees F.

4.04 HAND MIXING
Hand mixing shall be permitted when the amount of concrete required for any job is less than one (l) cubic yard. Hand mixed concrete shall be mixed on a watertight platform or in a mortar box in batches not to exceed 1/3 cubic yards each. The aggregate shall first be spread in a uniform layer over which the required quantity of cement shall be evenly distributed. The entire batch shall be turned with shovels until the ingredients are thoroughly blended before adding the water. After adding the proper amount of water, the batch shall again be turned with shovels until a uniform consistency is obtained. Methods of hand mixing which allow the loss of mixing water will not be permitted.

INSPECTION

Proper facilities shall be provided for the inspection and sampling of concrete at the mixing plant, loading plant, and place of delivery.

The manufacturer shall afford the inspector, without charge to the CFPUA, all reasonable facilities for securing samples to determine if the concrete is being furnished in accordance with the requirements of this specification. All inspection and sampling shall be so conducted as not to interfere unnecessarily with the manufacture and delivery of the concrete.

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6.01 HANLDING AND PLACING CONCRETE

No concrete shall be used which does not reach its final position in the forms within one (1) hour after water is first added to the mix, except when concrete is continually agitated, when the time may be extended to one and one-half (I Y2) hours. Concrete shall be placed so as to avoid segregation of the materials and the displacement of the reinforcement. The use of long chutes for conveying concrete from the mixer will be permitted only on written authority of the Engineer. In case an inferior quality of concrete is produced by the use of chutes, the Engineer may order discontinuance of their use and the substitution of a satisfactory method of placing. Open troughs and chutes shall be of metal or metal lines; where steep slopes are required, the chutes shall be equipped with baffle boards or be in short lengths that reverse the direction of movement. All chutes, troughs and pipes shall be kept free from coatings of hardened concrete by thoroughly flushing with water after each run; water used for flushing shall be discharged clear of the concrete already in place. Concrete shall not be dropped a distance of more than five (5) feet, and special care shall be taken to fill each part of the form by depositing the concrete as near final position as possible. The coarse aggregate shall be worked back from the face and the concrete forced around the reinforcement without displacing the bars. After initial set of the concrete, the forms shall not be jarred and no strain shall be placed on the ends of the projecting reinforcement. Concrete shall be compacted by continuous working with a suitable tool or by vibrating the forms in a manner acceptable to the Engineer; the mortar shall be flushed to the surface by the use of a suitable spading tool. If puddling cannot be done because of the obstruction of reinforcement or other cause, compacting shall be accomplished by vibrating the form in a manner satisfactory to the Engineer. Concrete shall be placed in horizontal layers not more than twelve (12") thick, except as hereinafter provided. When less than a complete layer is placed in one operation, it shall be terminated in a vertical bulkhead. Each layer shall be placed and compacted before the preceding batch has taken initial set to prevent injury to the green concrete and avoid surfaces of separation between the batches. Each layer shall be compacted so as to void the formation of a construction joint with a preceding layer which has not taken initial set. When placing of concrete is temporarily discontinued, the concrete, after becoming firm enough to sustain its form, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. To avoid visible joints as far as possible upon exposed faces, the top surface of the concrete adjacent to the form shall be smoothed with a trowel. Where a "Feather Edge" might be produced at a construction joint, inset form work shall be used to form the preceding layer so that the thickness of the edge shall be not less than six (6") inches. Work shall not be discontinued within eighteen (18 ") inches thick, in which case, if permitted by the Engineer, the construction joint may be made at the underside of the coping. Construction joints shall be placed across regions of low shearing stress, in locations which will be hidden from view to the greatest possible extent, and at only the locations shown on the plans or as directed by the Engineer. All concrete shall be placed so as to be properly finished and curing begun during the daylight hours. At no time shall concrete be placed which will require the finishing, etc., to be performed by artificial light. Paving operations shall be scheduled by the Engineer.

FINISHED AND CURING OF CONCRETE

7.01 FINISHING

Concrete for curb, curb and gutter, sidewalk and driveways shall have a broomed finish. This finish shall be accomplished as follows: The surface shall be screened and tamped with a special tool to force the coarse aggregate away from the surface, floated to bring the surface to the required finish level, steel-troweling to an even smooth surface and brooming with a fibre-bristle brush. The surface shall be of uniform texture.

7.02 CURING

Curing shall be accomplished by preventing loss of moisture, rapid temperature change, and mechanical injury or injury from rain or flowing water for a period of 7 days when normal Portland cement has been used or 3 days when high-early-strength Portland cement has been used. Curing shall be started as soon after placing and finishing as free water has disappeared from the surface of the concrete. Curing may be accomplished by any of the following methods or combination thereof, as approved.

7.02.1 MOIST CURING

Uniformed surfaces shall be covered with burlap, cotton, or other approved fabric mats, or with sand and shall be kept continually wet. Forms shall be kept continually wet and if removed before the end of the curing period, curing shall be continued as on uniformed surfaces, using suitable materials. Burlap shall be used only on surfaces which will be unexposed in the finished work and shall be in two layers.

7.02.2 WATERPROOF-PAPER CURING

Surfaces shall be covered with waterproof paper lapped 4 inches at edges and ends and sealed with masting or pressure-sensitive tape not less than I Y2 inches wide. Paper shall be weighted to prevent displacement, and tears and holes appearing during the curing period shall be immediately repaired by patching.

7.02.3 MEMBRANE CURING METHOD

The entire exposed surfaces shall be covered with a pigmented membrane-forming curing compound approved by the Engineer. The curing compound shall be applied in two coats by hand operated pressure sprayers at a coverage of approximately 200 square feet per gallon for both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected for 7 days from pedestrian and vehicular traffic and from any other action which might disrupt the continuity of the membrane. Any area covered with curing compound and damaged by subsequent construction operations within the 7-day curing period shall be resprayed at no additional expense to the CFPUA.

8.01 TABLE I – RECOMMENDED PROPORTIONS OF AGGREGATES

Maximum Size of Coarse Aggregate – Inches	Ratio of Fine (*) to Total Aggregate on Basis of Dry, Compacted Columns, Measured Separately	
	Minimum	Maximum
3/8”	0.55	0.70
3/4”	0.40	0.60
1” and over	0.30	0.50

(*) Note: The finer the sand, the lower will be the percentage required.

9.00 TABLE II – CONCRETE PROPORTIONS AND STRENGTH REQUIREMENTS

Min. Compo Strength Per Concrete Sq. In. at Classification Days	Type of Construction	Max. Water Gals. Per Bag Cement	Min Cement Bags per 1 Lb. Cubic Yard	28
AA. Reinforced Piles, Thin Walls Light Structural Members		5 ½	6 ¾	4000
A. Reinforced Retaining Walls Sewers, except Cradles, Side-Walks, Driveways and Curbs		6 ¾	5 ¾	3000
B. Retaining Walls non Rein-Forced, Cradles for Sewers		7 ½	5 ¼	2500
C. Additional Foundation, Mass Work Not Exposed to the Weather, Trench Paving		8 ¼	4 ¼	2000

10.00 SAMPLING AND TESTING

All sampling, curing and testing of Portland Cement concrete shall be in accordance with the current ASTM designation applicable to each case as listed in the subsections. Not less than three cylinders shall be taken for testing at anyone time. Unless otherwise directed by the Engineer, three cylinders shall be taken for breaking at seven days and three cylinders taken for breaking at twenty-eight (28) days from each batch to be tested. The cost of concrete for samples is to be considered incidental testing company. The Owner will pay the costs of the initial tests. Any retests will be paid by the Contractor.

10.01 SAMPLING FRESH CONCRETE: CI72 - Latest Revision

10.02 OBTAINING DRILLED CORES: C42 - Latest Revision

10.03 MOLDING AND CURING SPECIMENS: C31 - Latest Revision

10.04 COMPRESSING STRENGTH: C39 - Latest Revision

10.05 FLEXURAL STRENGTH: C78 - Latest Revision

10.06 SLUMP: Cl43 - Latest Revision

10.07 AIR CONTENT: Cl73 or C231 - Latest Revision

10.08 UNIT WEIGHT YIELD: Cl38 - Latest Revision

10.09 SETTING OF MORTAR: C191 or C266 - Latest Revision

11.00 PAYMENT

No separate payment for concrete will be made.

END OF SECTION 03 30 00

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

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. Chain-link fences.
2. Swing gates.
3. Horizontal-slide gates.
4. Privacy slats.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete **equipment bases/pads for gate operators and controls and post footings**.
2. Section 281300 "Access Control" for gate controls.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of gate operator.
3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.

1.4 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 the following:

a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Accessories:
d. Gates and hardware.
e. Gate operators, including operating instructions and motor characteristics.

B. Shop Drawings: For each type of fence and gate assembly.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.

3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

E. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For **professional engineer**

B. Product Certificates: For each type of chain-link fence, and gate.

C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by **manufacturer and witnessed by a qualified testing agency**.

D. Field quality-control reports.

E. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Emergency Access Requirements: According to requirements of authorities having jurisdiction for gates with automatic gate operators serving as a required means of access.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

A. Special Warranty: **Installer agrees** to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to comply with performance requirements.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Faulty operation of gate operators and controls.

2. Warranty Period: **Two (2)** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design chain-link fence and gate frameworks.

B. Structural Performance: Chain-link fence and gate frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to **ASCE/SEI 7**.

1. Design Wind Load: **120 mph**.

a. Minimum Post Size: Determine according to ASTM F 1043 for post spacing not to exceed **10 feet** for Material **Group IA, ASTM F 1043, Schedule 40 steel pipe**
b. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

C. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:

1. Fabric Height: **As indicated on Drawings**.
2. Steel Wire for Fabric: Wire diameter of **0.192 inch**.

a. Mesh Size: **2 inches.**
b. Polymer-Coated Fabric: ASTM F 668, **Class 2a** over **aluminum**-coated steel wire.

1) Color: **Black,** according to ASTM F 934.

c. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

3. Aluminum Wire Fabric: ASTM F 1183, with **mill** finish, and wire diameter of **0.192 inch**.

a. Mesh Size: **2 inches**.

4. Selvage: **Knuckled at both selvages**.

2.3 FENCE FRAMEWORK

A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:

1. Fence Height: **As indicated on Drawings**.
2. Light-Industrial-Strength Material: **Group IC-L, round steel pipe, electric-resistance-welded pipe**.

   a. Line Post: **1.9 inches in diameter**.
   b. End, Corner, and Pull Posts: **2.375 inches**.

3. Heavy-Industrial-Strength Material: **Group IA, round steel pipe, Schedule 40**.

   a. Line Post: **2.375 inches in diameter**.
   b. End, Corner, and Pull Posts: **2.875 inches in diameter**.

4. Horizontal Framework Members: **top and bottom** rails according to ASTM F 1043.

   a. Top Rail: **1.66 inches in diameter**.

5. Brace Rails: ASTM F 1043.
6. Metallic Coating for Steel Framework:

   a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating according to ASTM A 653/A 653M.
   b. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
   c. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
   d. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
   e. Coatings: Any coating above.

7. Polymer coating over metallic coating.

   a. Color: **Black,** according to ASTM F 934.

2.4 TENSION WIRE

A. Metallic-Coated Steel Wire: 0.177-inch-diameter, marcelled tension wire according to ASTM A 817 or ASTM A 824, with the following metallic coating:

1. Type I: Aluminum coated (aluminized).
2. Type II: Zinc coated (galvanized) by **electrolytic** process, with the following minimum coating weight:

   a. Class 3: Not less than 0.8 oz./sq. ft. of uncoated wire surface.
   b. Class 4: Not less than 1.2 oz./sq. ft. of uncoated wire surface.
   c. Class 5: Not less than 2 oz./sq. ft. of uncoated wire surface.
   d. Matching chain-link fabric coating weight.

3. Type III: Zn-5-Al-MM alloy with the following minimum coating weight:

   a. Class 60: Not less than 0.6 oz./sq. ft. of uncoated wire surface.
   b. Class 100: Not less than 1 oz./sq. ft. of uncoated wire surface.
   c. Matching chain-link fabric coating weight.

B. Polymer-Coated Steel Wire: **0.148-inch-**diameter, tension wire according to ASTM F 1664, **Class 2b** over **aluminum**-coated steel wire.

1. Color: **Black,** according to ASTM F 934.

C. Aluminum Wire: 0.192-inch-diameter tension wire, mill finished, according to ASTM B 211, Alloy 6061-T94 with 50,000-psi minimum tensile strength.

2.5 SWING GATES

A. General: ASTM F 900 for gate posts and **single and double** swing gate types.

1. Gate Leaf Width: **As indicated**.
2. Framework Member Sizes and Strength: Based on gate fabric height **as indicated**.

B. Pipe and Tubing:

1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; **manufacturer's standard protective coating and finish**.
2. Aluminum: ASTM B 429/B 429M; **manufacturer's standard** finish.
3. Gate Posts: **Round tubular steel**.
4. Gate Frames and Bracing: **Round tubular steel**.

C. Frame Corner Construction: **Welded**.

D. Hardware:

1. Hinges: **360-degree inward and outward** swing.
2. Latch: Permitting operation from both sides of gate **with provision for padlocking accessible from both sides of gate**.
3. Lock: **Manufacturer's standard** internal device.
4. Padlock and Chain: Provided by Owner, however; Contractor shall coordinate lock type with Owner to be certain gate can accept the lock.
5. Closer: **Manufacturer's standard**.

2.6 FITTINGS

A. Provide fittings according to ASTM F 626.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive tension wire or top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: **Pressed-steel or round-steel tubing** not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting **bottom** rails to posts.

E. Tension and Brace Bands: **Pressed steel**.

F. Tension Bars: **Steel**, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: **Steel, hot-dip galvanized after threading** rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:

a. Hot-Dip Galvanized Steel: **0.106-inch-**diameter wire**; galvanized coating thickness matching coating thickness of chain-link fence fabric**.
b. Aluminum: ASTM B 211; Alloy 1350-H19; **0.148-inch-**diameter, mill-finished wire.

I. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

a. Polymer coating over metallic coating.

2. Aluminum: Mill finish.

2.7 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

B. 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. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating, and that is recommended in writing by manufacturer for exterior applications.

2.8 GROUNDING MATERIALS

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for **a certified survey of property lines and legal boundaries,** site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.

1. Install fencing on established boundary lines inside property line.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts **in concrete** at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.
    b. Concealed Concrete: Place top of concrete **as indicated on Drawings** to allow covering with surface material.
    c. Posts Set into Sleeves in Concrete: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with **nonshrink, nonmetallic grout**, mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.
    d. Posts Set into Holes in Concrete: Form or core drill holes not less than 5 inches deep and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with **nonshrink, nonmetallic grout** mixed and placed according to anchoring material manufacturer's written instructions. Finish anchorage joint to slope away from post to drain water.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of **15 degrees or more**. For runs exceeding 500 feet, space pull posts an equal distance between corner or end posts.

E. Line Posts: Space line posts uniformly at **96 inches** o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at midheight of fabric 72 inches or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch-diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along **top** and **bottom** of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
2. Extended along top of **extended posts** and top of fence fabric to support barbed tape.

H. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

I. Intermediate and Bottom Rails: Secure to posts with fittings.

J. Chain-Link Fabric: Apply fabric to **outside** of enclosing framework. Leave **1-inch** bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

K. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

L. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.

1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.

M. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. **Peen ends of bolts or score threads to prevent removal of nuts.**

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fence and Gate Grounding:

1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
2. Install ground rods and connections at maximum intervals of **1500 feet**.
3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of **750 feet**.
4. Ground fence on each side of gates and other fence openings.

   a. Bond metal gates to gate posts.
   b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a ground rod located a maximum distance of 150 feet on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground according to IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

F. Connections:

1. Make connections with clean, bare metal at points of contact.
2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
4. Make above-grade ground connections with mechanical fasteners.
5. Make below-grade ground connections with exothermic welds.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

G. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

H. Comply with requirements in Section 264113 "Lightning Protection for Structures."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: **Owner will engage** a qualified testing agency to perform tests.

B. Grounding Tests: Comply with requirements in Section 264113 "Lightning Protection for Structures."

C. Prepare test reports.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 32 91 13
SOIL PREPARATION

PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment and supervision necessary to provide and prepare soil for seeding, sodding, and landscape planting. Included are the following topics:

1.01 SECTION INCLUDES

A. PART 1 - GENERAL
Scope
Related Sections
Unit Prices
Definitions
Regulatory Requirements
Reference Standards
Submittals
Quality Assurance
B. PART 2 - MATERIALS
Topsoil
Soil Amendments
Fertilizer
C. PART 3 - EXECUTION
Subgrade Soil Preparation
Placing Topsoil
Organic Soil Amendments and pH Adjustment
Fertilizer

1.02 RELATED SECTIONS

A. Section 31 22 00 – Grading: Topsoil material.
B. Section 31 22 00 – Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
C. Section 31 23 23 – Fill and Backfill: Topsoil material.

1.03 UNIT PRICES - MEASUREMENT AND PAYMENT

A. See Section 01 20 00 - Unit Prices, for additional unit price requirements.
B. Topsoil:
1. Basis of Measurement: By the cubic yard.
2. Basis of Payment: Includes topsoil, placing topsoil.

1.04 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than sizes indicated diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

C. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant or desiccant.

G. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals or people. These include insects, mites, grubs, mollusks (snails or slugs), rodents, unwanted plants (weeds), fungi, bacteria and viruses.

H. Planting Soil: The following types of standardized topsoil: existing in-place surface topsoil, surface soil modified to become topsoil imported topsoil, or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

I. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

J. Weeds but are not limited to: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.05 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.06 REFERENCE STANDARDS

A. ASTM D5268-07 Standard Specification for Topsoil Used for Landscaping
B. USDA Agricultural Handbook No. 60 Diagnosis and Improvement of Saline and Alkali Soils
C. American Nursery and Landscape Association

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened, labeled, and undamaged containers showing weight, name of manufacturer and indication of conformance with state and federal laws (as applicable). Store and handle materials according to manufacturer's and supplier's recommendations.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements or on existing turf areas or plants.

2. Provide erosion control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems or walkways.

3. Accompany each delivery of bulk fertilizers, lime and/or soil amendments with appropriate certificates. Provide copies of these to the Owner/Architect upon request.

C. Pesticides:

1. Handle all pesticides in accordance with federal, state and local rules and regulations.

2. Do not store these products near structures, utilities, walkways and pavements or on existing turf areas or plants.

1.08 SUBMITTALS

A. Soil Testing: For existing soil in landscape areas, provide testing results and analysis or recommendations from an independent third party testing laboratory to correct deficiencies or problematic soil conditions.

B. Material Test Reports: Provide copies of all quality assurance testing reports for all soils intended for use in planting or turf areas on the site. Reports required for at least: existing surface soil, manufactured soil, imported soil in planting areas and soil intended for use as planting soil (if different than existing surface soil).

C. Provide product data, including applicable analytical data, for soil amendments including but not limited to:

- Peat products
- Lime
- Fertilizer

1.09 QUALITY ASSURANCE

The Contractor shall retain the services of an independent soil testing laboratory to process soil sampling, testing and analysis of salvaged and imported soil and amendments as required by this section and elsewhere in the Contract Documents. The materials testing consulting Architect/Engineer shall be subject to approval by the Owner.

Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

Soil Analysis: A soil test and analysis of a wide representation of soils through out the intended planting and turf areas. For each unamended soil type and each selected location, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil. The test results should also include the soil-testing laboratory's recommendations for any corrective measures needed to grow healthy, thriving specified plant material or turf on the site.

Testing methods and written recommendations shall comply with USDA's Handbook No. 60.

The soil-testing laboratory shall be given samples with information including depth and location, and number of samples taken over the entire site. If the Owner or Architect chose, the contractor may be required to have the soil-testing laboratory oversee the soil sampling. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.

Report suitability of and recommended alterations of tested soil for healthy, thriving plant & turf growth.

Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.

Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

Fertilizer shall be delivered to the site in original, sealed containers, and stored in a waterproof space. Containers shall bear the manufacturer's name, analysis, trademark and guarantee unless otherwise approved by Owner or Architect.

Collection of soil specimens shall be complete in accordance with accepted practices, and shall be subject to approval by the Owner.

PART 2 - PRODUCTS

2.01 TOPSOIL

Clean salvaged or imported material capable of passing the 1" sieve and meeting the requirements of Section 625.2(1) of the Standard Specifications for Highway Construction. The material shall be free of rocks, gravel, wood, debris, and of noxious weeds and their seeds.

2.02 SOIL AMENDMENTS

Soil amendments acceptable as part of a backfill mix (if appropriate according to soils testing report) include but not limited to:

- Peat Moss - Type 1 sphagnum, weed and seed free, 3.1-5.0 pH
- Sedge Peat - decomposed peat with no identifiable fibers
- Leaf Compost - screened and free of trash and other debris
- Compost - standard commercial grade compost of sheep or cow manure
- Pine Bark - potting grade pine bark with no particles larger than 1/2" (1.3 cm), less than 10% wood fiber
- Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
- Class: Class T, with a minimum 99 percent passing through No. 8 (2.36-mm) sieve and a minimum 75 percent passing through No. 60 (0.25-mm) sieve.
- Class: Class O, with a minimum 95 percent passing through No. 8 (2.36-mm) sieve and a minimum 55 percent passing through No. 60 (0.25-mm) (0.25 mm) sieve.
- Provide lime in form of ground dolomitic limestone.
- Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through no. 6 (3.35 mm) sieve and a maximum 10 percent passing through No. 40 (0.425 mm) sieve.
- Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- Aluminum Sulfate: Commercial grade, unadulterated.
- Perlite: Horticultural perlite, soil amendment grade.
- Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate with 90 percent passing through No. 50 (0.30 mm) sieve.
- Sand: Clean, washed, natural or manufactured, free of toxic materials.
- Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

Soil amendments shall be capable of passing the 1" sieve. The material shall be free of rocks, gravel, wood, debris, and of noxious weeds and their seeds. Any soil amendments other than those listed above should be approved by Owner and/or Architect prior to use on site.

2.03 FERTILIZER

Use commercially available fertilizer meeting the following requirements: commercial grade complete fertilizer of neutral character, consisting of fast and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the composition as recommended by the findings and recommendations in the soils report.

All fertilizers shall be delivered fully labeled according to applicable regulations, bearing name, trade name or trademark of producer, along with producer's warranty. Application amounts of fertilizer and lime will be governed by the recommendations of the soil test.

PART 3 - EXECUTION

3.01 SUBGRADE SOIL PREPARATION

Remove or mow all vegetation to a height 3”. Remove all rocks, debris, and litter that will prevent compliance with topsoil and seeding specifications. Final grade area to within 2” of subgrade elevations. Rake, till or disc the subsoil to a depth of 2”-4” to allow aeration.

3.02 PLACING TOPSOIL

Place topsoil to achieve final grades indicated on the Drawings, allowing for settlement. Place topsoil to the depth shown on the Drawings. If no depth is shown provide a minimum of 4” of topsoil.

Do not apply topsoil to saturated or frozen subgrades.

3.03 ORGANIC SOIL AMENDMENTS AND pH ADJUSTMENT

Provide organic soil amendments and lime as recommended soil analysis. If topsoil has been determined acceptable by a soil test, no amendments are needed.

Uniformly apply organic soil amendments and lime, and incorporate into the top 4”-6” of soil by tilling or discing.

3.04 PRE-EMERGENT HERBICIDE

Pre-emergent herbicides shall be applied in accordance with any local, state, or federal guidelines to control weeds in planting and turf areas.

3.05 FERTILIZER

Fertilizer shall be applied in accordance with the recommendations of the soils test.

END OF SECTION 32 91 13

SECTION 32 92 19
SEEDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.
B. Placing topsoil.
C. Seeding, mulching and fertilizer.
D. Maintenance.

1.02 RELATED SECTIONS

A. Section 31 22 00 - Grading: Topsoil material.
B. Section 31 22 00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
C. Section 31 23 23 - Fill and Backfill: Topsoil material.

1.03 UNIT PRICES - MEASUREMENT AND PAYMENT

A. See Section 01 20 00 - Unit Prices, for additional unit price requirements.
B. Topsoil:
   1. Basis of Measurement: By the cubic yard.
   2. Basis of Payment: Includes topsoil, placing topsoil.
C. Grassed Areas:
   1. Basis of Measurement: By the square yard.
   2. Basis of Payment: Includes preparation of subsoil, placing topsoil, seeding, watering and maintenance to specified time limit.

1.04 DEFINITIONS

A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.05 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.07 MAINTENANCE SERVICE

A. Furnish maintenance of seeded areas for three months from Date of Substantial Completion.
B. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

PART 2 - PRODUCTS

2.01 SEED MIXTURE

A. Seed Mixture: Refer to seeding schedule located on construction documents sheet C-1.0, General Notes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this Section.

3.02 PREPARATION

A. Prepare subgrade in accordance with Section 31 22 00.
B. Place topsoil in accordance with Section 31 22 00.

3.03 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.
B. Apply after smooth raking of topsoil and prior to roller compaction.
C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
D. Mix thoroughly into upper 2 inches of topsoil.
E. Lightly water to aid the dissipation of fertilizer.

3.04 SEEDING

A. Apply seed in accordance with NCDOT Standard Specifications for Roads and Structures, July 2006.
B. Do not seed areas in excess of that which can be mulched on same day.
C. Do not sow immediately following rain, when ground is too dry, or during windy periods.
D. Immediately following seeding and compacting, apply mulch to a thickness of 1/8 inches. Maintain clear of shrubs and trees.
E. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.
F. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.
G.. Finished surface of seeded area and underlying grade to be smooth without dips, trenches, or depressions. Any irregularities should be repaired immediately and the site should be monitored regularly to address problems as they occur.

3.05 MAINTENANCE

A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
B. Water to prevent grass and soil from drying out and to maintain healthy, viable turf grass.
C. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
D. Immediately reseed areas which show bare spots.

END OF SECTION 32 92 19

SECTION 32 92 23
SODDING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation of subsoil.
B. Placing topsoil.
C. Fertilizing.
D. Sod installation.
E. Maintenance.

1.02 RELATED SECTIONS

A. Section 31 22 00 - Grading: Topsoil material.
B. Section 31 22 00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
C. Section 31 23 23 - Fill and Backfill: Topsoil material.

1.03 UNIT PRICES - MEASUREMENT AND PAYMENT

A. See Section 01 20 00 - Unit Prices, for additional unit price requirements.
B. Topsoil:
   1. Basis of Measurement: By the cubic yard.
   2. Basis of Payment: Includes topsoil, placing topsoil.
C. Sodded Areas:
   1. Basis of Measurement: By the square yard.
   2. Basis of Payment: Includes preparation of subsoil, placing topsoil, sodding, watering and maintenance to specified time limit.

1.04 REFERENCES

A. TPI (SPEC) - Guideline Specifications to Turfgrass Sodding; Turfgrass Producers International; 1995.

1.05 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.06 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.
B. Do not deliver more sod than can be laid within 24 hours.

1.08 MAINTENANCE SERVICE

A. Furnish service and maintenance of sodded areas for three months from Date of Substantial Completion.
B. Maintain sodded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sod: TPI, Certified Turfgrass Sod quality; cultivated grass sod; type indicated in plant schedule on Drawings; with strong fibrous root system, free of stones, burned or bare spots; containing no more than 5 weeds per 1000 sq ft. Minimum age of 18 months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.
B. Topsoil: as specified in Section 31 20 30.
C. Fertilizer: recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated by analysis.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this section.

3.02 PREPARATION

A. Prepare subgrade in accordance with Section 31 22 00.
B. Place topsoil in accordance with Section 31 22 00.

3.03 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.
B. Apply after smooth raking of topsoil and prior to installation of sod.
C. Apply fertilizer no more than 48 hours before laying sod.
D. Mix thoroughly into upper 2 inches of topsoil.
E. Lightly water to aid the dissipation of fertilizer.

3.04 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.
B. Lay sod immediately after delivery to site to prevent deterioration.
C. Lay sod tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.

D. Lay smooth. Align with adjoining grass areas.
E. On slopes 6 inches per foot and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.
F. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.

G. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities. Roll sodded areas with roller not exceeding 150#/ft of roller width.
H. Finished surface of sod and underlying grade to be smooth without dips, trenches, or depressions. Any irregularities should be repaired immediately and the site should be monitored regularly to address problems as they occur.

3.05 MAINTENANCE

A. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.
B. Water to prevent grass and soil from drying out or as otherwise required to maintain healthy, viable turf grass.
C. Roll surface to remove irregularities.
D. Level out any irregularities in soil/turf grade.
E. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
F. Immediately replace sod to areas which show deterioration or bare spots.

END OF SECTION 32 92 23

SECTION 33 01 12

IDENTIFICATION FOR UTILITIES PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Underground Pipeline Detection and Warning.
      a. Tracer wire system
         1) Vinyl/PVC adhesive tape.
         2) Polyethylene adhesive tape.
         3) Direct bury wire splice kits.
      b. Tracer wire system testing
      c. Metal detectable underground warning tape.
      d. Marker posts.
   2. Above Ground Piping and Valve Identification at CFPUA Facility Sites.
      a. Tags
      b. Applied pipe markers.

B. Related Requirements:
   1. Section 09 91 00 - Painting and Protective Coating: Execution requirements for painting specified by this Section.
   2. Section 33 05 07.13 - Horizontal Directional Drilling: Materials and methods for piping and appurtenances.
   3. Section 33 05 07.23 - Jacking and Boring: Materials and methods for carrier pipes and appurtenances.
   4. Section 33 14 13 - Water Distribution Piping and Appurtenances: Materials and methods for piping and appurtenances.
   5. Section 33 14 14 - Public Water Service Connections: Materials and methods for piping, valves, and appurtenances.
   6. Section 33 31 23 - Sanitary Sewer Force Mains, Valves and Appurtenances: Materials and methods for piping, valves, and appurtenances.
   7. Section 40 71 00 - Magnetic Flow Meter
   8. Section 43 21 39.13 - Submersible End Suction Pumps: Materials and methods for piping, valves, pumps, and other station equipment.

1.2 REFERENCE STANDARDS

A. NCGS 87-8A Underground Utility and Damage Prevention Act

B. American Public Works Association: Uniform Color Code

C. American Society of Mechanical Engineers: ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's catalog literature for each product required.

PART 2 PRODUCTS

2.1 UNDERGROUND PIPELINE DETECTION AND WARNING

1. Tracer Wire
   a. Vinyl/PVC adhesive tape.
   b. Polyethylene adhesive tape.
2. Direct bury wire splice kits.
3. Metal detectable underground warning tape.
4. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Material
K-Miscellaneous	Warning Tape
L-Electrical	Wire and splice kits

2.2 ABOVE GROUND PIPING AND VALVE IDENTIFICATION

A. Above Grade Pipe Identification
   1. Color-Coding and Lettering Size: Conform to ASME A13.1.
   2. Applied Pipe Markers
      a. Factory-fabricated, flexible, semi-rigid plastic.
      b. Preformed to fit around pipe or pipe covering.
      c. Larger sizes may have maximum sheet size with spring fastener.
   3. Applied Tape Pipe Markers
      a. Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.
   4. Stencils
      a. Clean-cut symbols.
      b. Letters:
         1) Up to 2-inch Outside Diameter of Insulation or Pipe === ½-inch high letters.
         2) 2-½- to 6-inch Outside Diameter of Insulation or Pipe == 1-inch high letters.
         3) Over 6-inch Outside Diameter of Insulation or Pipe == 1-¾-inch high letters.
         4) Stencil Paint: As specified in Section 099000 - Painting and Coating; semi-gloss enamel.

B. Valves
   1. Plastic Tags
      a. Laminated three-layer plastic with engraved letters on light, contrasting background color.
      b. Minimum Tag Size and Configuration: 1-½ inch.
   2. Metal Tags
      a. Stainless-steel construction; stamped letters.
      b. Minimum Tag Size and Configuration: 1-½ inch with finished edges.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify prescribed materials and color code for each pipeline type to be installed.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Prepare surfaces as specified in Section 09 90 00 - Painting and Protective Coating for stencil painting.

3.2 INSTALLATION

A. Buried Pipeline Detection and Warning
   1. Tracer wire system termination and access.
      a. Tracer wire systems must be installed as a single continuous wire. No looping or coiling of wire is allowed.
      b. All tracer wire termination points must be grade level/in-ground access boxes identified with “sewer” or “water” cast into the cap.
      c. A minimum of 2 ft. of excess/slack wire is required in all tracer wire access boxes after meeting final elevation.
      d. Runs without service laterals or hydrants shall provide intermediate tracer wire access at minimum 1,000-foot intervals and must be provided utilizing a grade level/in-ground access box located at the edge of the road right-of-way and outside the roadway surface.
      e. Termination and access shall be installed as indicated on the Drawings for all pressure piping at the following locations:
         1) Cast iron boxes located at minimum 1,000-foot intervals
         2) All in-line valve boxes on water mains and services and on sewer force mains and services.
         3) At hydrant valve boxes and hydrants
         4) Water meter service boxes
   2. Tracer wire repairs
      a. Any damage occurring during installation of the tracer wire must be immediately repaired by removing the damaged wire and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
   3. Tracer wire attachment and connections
      a. Tracer wire shall be installed at the top half (11-1 o’clock position) of the pipe and secured (taped/tied) at 12-foot intervals.
      b. Mainline tracer wire shall not be connected to existing conductive pipes. Treat as a mainline dead end and ground using an anode buried at the same depth as the tracer wire.
      c. All service lateral tracer wires shall be a single wire, connected to the mainline tracer wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline tracer wire.
      d. In occurrences where an existing tracer wire is encountered on an existing utility that is being extended or tied into, the new tracer wire and existing

tracer wire shall be connected using approved splice connectors and shall be properly grounded at the splice location as specified.

e. A mainline tracer wire must be installed, with all service lateral tracer wires properly connected to the mainline tracer wire, to ensure full tracing/locating capabilities from a single connection point.
f. Lay Mainline tracer wire continuously on the North or East side of valves and fittings.
g. Tracer wire on all service laterals must terminate at an approved tracer wire access located directly above the service lateral at the edge of road right of way.
h. Connect tracer wire using direct bury splice kits in accordance with manufacturer's recommendations

4. Tracer wire testing and verification
   a. Provide locating equipment to verify tracer wire locating system in presence of CFPUA or ENGINEER construction observer.
   b. The test will take the following form:
      1) A standard 5-watt generator will be used to provide an AC current on the wire.
      2) The frequency of the signal from the generator will be initially restricted to 33 kHz or less.
      3) A standard hand-held detector will be used to trace the signal.
   c. The installed tracer wire will be deemed to pass the test if using the above set up:
      1) The tracer wire is accessible at all access points.
      2) The tracer wire can be traced from access point to access point.
      3) Widely spaced access points can be traced out in the worst-case from each end to a common meeting point between them.
      4) Depth readings are consistent and accurate to within a 15:1 depth to diameter ratio.
5. Horizontal Directional Drill and Bore/Jack Crossings
   a. Follow special tracer wire procedures identified in those specification sections.

B. Buried Pipeline Metal Detectable Warning Tape
   a. For all diameter potable water mains (excluding 1-inch service lines) and all diameter sewerage force mains
      1) Install 1'-6" deep and directly above pipeline during backfilling operation.

C. Above Ground Piping and Valve Identification at CFPUA Facility Sites:
1. Piping:
   a. Identify with plastic tape pipe markers or stenciled painting.
   b. Apply stencil painting as specified in Section 09 90 00 - Painting and Protective Coating.
   c. Identify service, flow direction, and pressure.
   d. Install in clear view and align with axis of piping.
   e. Locate identification not to exceed 20 feet on straight runs, including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
2. Valves:
   a. Install tags using corrosion-resistant chain.

b. Number tags consecutively by type and location.

END OF SECTION

SECTION 33 14 13

WATER DISTRIBUTION PIPING, VALVES, HYDRANTS, AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

A. Section Includes Installation of:
   1. Pipe and fittings for public water mains and service connections.
   2. Valves, fire hydrants, blow offs, sampling stations, air release assemblies, and other water distributions appurtenances.

B. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 03 05 00 - Concrete.
   3. Section 09 91 00 - Painting and Protective Coatings.
   4. Section 31 23 34.01 - Excavating, Trenching, Dewatering and Backfilling.
   5. Section 33 01 12 - Identification for Utilities Piping.
   6. Section 33 05 05.31 - Hydrostatic Testing.
   7. Section 33 05 09.33 - Thrust Restraint for Utility Piping.
   8. Section 33 05 13 - Precast Concrete Manholes and Utility Structures.
   9. Section 33 14 14 - Public Water Service Connections.
   10. Section 33 14 20 - Disinfection of Water Pipelines, Facilities and Appurtenances.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 – Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   1. ASME B16.1 – Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. ASTM International:
   1. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.
   2. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3).
   3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
   4. ASTM D1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   5. ASTM D2241 – Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
   6. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
   7. ASTM D3139 – Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

8. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
9. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

D. American Water Works Association:
1. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C110 – Ductile-Iron and Gray-Iron Fittings.
4. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
5. AWWA C115 – Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
6. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray Iron Fittings.
7. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast.
8. AWWA C153 – Ductile-Iron Compact Fittings.
9. AWWA C500 – Metal-Seated Gate Valves for Water Supply Service.
10. AWWA C502 – Dry-Barrel Fire Hydrants.
11. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
12. AWWA C512 – Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service.
13. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.
14. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances.
15. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
16. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm), for Water Transmission and Distribution.
17. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
18. AWWA C906 – Polyethylene Pressure Pipe and Fittings, 4-In. Through 65-In. for Waterworks.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP-60 – Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

F. National Fire Protection Association:
1. NFPA 24 – Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
2. NFPA 291 – Recommended Practice for Fire Flow Testing and Marking of Hydrants.

G. NSF International:
1. NSF 61 – Drinking Water System Components - Health Effects.
2. NSF 372 – Drinking Water System Components - Lead Content.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements

B. Coordination:
   1. Coordinate Work of this Section with termination of water main connection at Site boundary, connection to CFPUA, and trenching.
   2. The existing system must be kept in operation at all times. Where connections are made to existing mains or other shutdowns are necessary, permission must be obtained and arrangements must be made with the CFPUA Distribution ORC, Utility Services Division for removing from service those mains that will be affected.
   3. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject of penalties in accordance with CFPUA's ordinance.
   4. Notify CFPUA no less than two business days prior to an event requiring a CFPUA representative to be present.
   5. The Contractor shall, at least two business days in advance, notify citizens subject to interruption of service by means of door hangers or any other approved method of the starting time and duration of such interruption.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittals: Requirements for submittals.

B. Product Data/Source Quality:
   1. Manufacturer information regarding pipe, pipe fittings, valves, hydrants, and appurtenances including component material, assembly, and parts diagrams.
   2. Shop test results and inspection data, certified by manufacturer.

C. Testing Procedures:
   1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER and CFPUA approval prior to commencing testing.

D. Manufacturer Instructions:
   1. Detailed instructions on installation requirements, including storage and handling procedures.

E. Manufacturer's Certificate:
   1. Certify that products meet or exceed specified requirements.

F. Field Quality-Control Submittals:
   1. Results of Contractor-furnished laboratory testing and field test results.

1.5 CLOSEOUT SUBMITTALS:

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Project Record Documents:
   1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work.
   2. Record actual locations of piping mains, valves, hydrants, connections, thrust restraints, elevations, and other utilities found and not indicated on design plans.

C. Operations and Maintenance Data:
   1. Furnish in operations and maintenance manuals complete data for materials in accordance with Section 01 60 00 - Product Requirements.

1.6 QUALITY ASSURANCE

A. Qualifications: Company specializing in manufacturing products specified in the CFPUA Materials Specification Manual.
   1. Cast manufacturer's name, pressure rating, and year of fabrication into valve body.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

C. Perform Work according to AWWA and PVC Pipe Association standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Block individual and stockpiled pipe lengths to prevent moving.
   3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
   4. Store PE and PVC materials out of sunlight.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.8 SITE CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.9 WARRANTY

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Furnish 10-year manufacturer's warranty for valves.

PART 2 PRODUCTS

2.1 CFPUA MATERIAL SPECIFICATION MANUAL

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Material
A	Pipe
B	Fittings and Accessories
C	Joint Restraints
D	Valves and Accessories
E	Fire Hydrants
F	Service Saddles and Tapping Devices
I	Castings & Aluminum Access Covers
K	Miscellaneous
L	Electrical
M	Coatings and Sealants

2.2 MATERIALS & ACCESSORIES

A. Bedding, Cover, and Backfill:
   1. As specified in Section 31 23 34.01 - Excavating, Trenching, Dewatering and Backfilling.

B. Pipe Location Wire: As specified in Section 33 01 12 - Identification for Utilities Piping.

C. Thrust Restraints: As specified in Section 33 05 09.33 - Thrust Restraint for Utility Piping.

D. Service Connections: As specified in Section 33 14 14 - Public Water Service Connections.

E. Vaults and Utility Boxes: As specified in Section 33 05 13 - Precast Concrete Manholes and Utility Structures.

F. Fire Hydrant Drainage Gravel: Provide #57 Stone.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Identify project horizontal and vertical control points, establish easement and right-of-way lines, stakeout construction points for work and pipeline alignments, establish limits of disturbance.

C. Determine exact location and size of water mains, valves, hydrants, and appurtenances from Drawings

D. Verify location and elevation of existing facilities prior to excavation and installation of proposed interconnecting water mains, valves, and hydrants.

3.2 PREPARATION

A. Section 01 35 00 - Special Procedures.
   1. Pre-construction Site Audio/Video Inspections and Photography:
   2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.

B. Section 01 70 00 - Execution and Closeout Requirements.

C. All materials, unless otherwise directed, shall be unloaded as nearby as possible to the location of installation by the Contractor. Materials shall be handled with care to avoid damage.

D. All materials found during the progress of work to have flaws, cracks, or other defects will be rejected by the Engineer regardless of whether or not it has been installed and shall be replaced by and at the expense of the Contractor.

E. All PVC pressure pipe, upon delivery to the site and until such time as it is placed in the trench, shall be shielded from the weather and direct sunlight to prevent pipe deterioration.

F. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surfaces, interior linings, and components. If any part of the coating, lining or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer prior to attempting installation.

G. Pipe Cutting:
   1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
   2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
   3. Grind edges smooth with beveled end for push-on connections.

H. Remove scale and dirt on inside and outside before assembly.

I. Prepare pipe connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Placement: As specified in Section 31 23 34.01 - Trenching, Excavation, Dewatering and Backfilling.
   1. All mains shall be laid and maintained at the required lines and grades with fittings, valves, and appurtenances at the described locations. All pipe shall be laid to the depth as shown on the drawings, or when a depth is not indicated, with a minimum cover of thirty (30) inches and a maximum of (60) inches below finished grade. Grade lines shall be set by the Contractor. Realignments must be approved by the Engineer. The Contractor shall have suitable survey equipment on the site at all times.

2. After placement in the trench the spigot end of the pipe shall be centered in the bell and the pipe shall be driven home and then brought to the proper line and grade by tamping approved backfill material under it, except for the bell. Joint deflection shall not exceed manufacturer's limit.
3. The Work shall at all times progress with caution so as to prevent damage to underground obstructions both known and unknown. Should an obstruction not shown on the drawings be encountered, the Engineer shall be immediately notified, and he shall be responsible for alteration to the design should realignment be necessary. Notify the Engineer far enough in advance to allow the realignment to be accomplished by deflection in the pipe joints.

B. Pipe and Fittings:
1. Handle and assemble pipe according to manufacturer instructions.
2. Install pipe and fittings in strict conformance with AWWA C600 and AWWA C605.
3. Install plastic pipe in conformance with ASTM D2774 and recommended practices of the UNI-BELL Plastic Pipe Association.
4. Joint Deflection: Maximum joint deflection shall meet requirements of AWWA C600, AWWA C605, or AWWA Manual of Practice M23.
5. Prevent foreign material from entering pipe during placement. Seal pipe openings with watertight plugs during Work stoppages using plugs designed for that purpose. If trench contains standing water in joining zone, plug shall remain in place until the trench has been pumped dry before proceeding pipe laying.
6. Allow for expansion and contraction without stressing pipe or joints.
7. Install access fittings to permit disinfection of water system performed under Section 33 14 20 – Disinfection of Water Distribution Mains.
   a. Blowoffs shall be installed for pipe flushing, disinfection, and test sampling.
   b. Blowoffs shall be located as follows:
      1) Dead ends.
      2) Stub-outs greater than one pipe section in length for future interconnecting mains.
      3) Valves closed against disinfection, flushing, and sampling.
   c. Blowoff should be installed as follows:
      1) Opening pointing downward.
      2) Minimum 24-inches clearance between opening and ground for proper sampling.
8. Cover: Measure depth of cover from final surface grade to top of pipe barrel and record.
9. Jointing:
   a. Fused HDPE:
      1) HDPE Pipe shall be joined by the butt-fusion process in accordance with pipe manufacturer’s directions.
      2) Contractor shall provide butt-fusion technicians who are trained and certified by the HDPE pipe manufacturer to complete the project. The date of technician certification shall not exceed 12 months before commencing construction.
      3) Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure.

4) The internal and external beads resulting from the butt-fusion process shall be visible and examined for penetration 360 degrees around the pipe diameter.
5) DI/HDPE Mechanical Joint Adaptors shall be ductile iron mechanical joint fittings per CFPUA Material Specification Manual and shall be joined to the HDPE pipe by a heat-fused joint on one end, and connected to a ductile iron pipe valve, or fitting with a mechanical joint on the other end.
6) Solvent epoxy cementing, electro-fusion couplings, and mechanical joining with bolt on wrap around clamps or mechanical joints without an adapter shall not be used for connections.

b. Push-On Joints:
1) The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove dirt, grit, oil or excess coatings and other foreign matter. For ductile iron pipe, the gasket shall be flexed inward and inserted in the gasket recess of the bell socket.
2) A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot ends, care will be taken to avoid contact with the ground.
3) The joint shall be completed by forcing the plain end to the bottom of the socket with a forked tool or jacking device or other approved method. All pipe shall have depth mark prior to insertion. Pipe cut in the field shall be filed to resemble the spigot end of manufactured pipe.
4) When deflection is required, the joint shall be completed prior to setting the deflection. The deflection shall conform to applicable AWWA Standards or manufacturer's recommendation.

c. Mechanical Joints:
1) The inside of the socket, the outside of the spigot end and the gland shall be thoroughly cleaned and or washed with an approved solution to remove dirt, grit, oil or excess coatings and foreign matter to improve gasket seating.
2) The gland shall then be placed on the plain end of the pipe with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end of the pipe.
3) The pipe shall be inserted into the socket and the gasket pressed firmly and evenly into the gasket recess. The joint shall be kept straight during the assembly and any deflection required shall be done after the joint has been assembled but prior to tightening the bolts.

C. Valves:
1. Valves shall be set and joined to the pipe and each type of joint as specified for pipe.
2. Cast iron valve boxes shall be firmly supported, maintained centered and plumb over the operating nut of the valve. Outside of paved areas, valve boxes shall be set in a 2' diameter x 6" thick concrete collar. The box cover shall be flush with the surface of the finished pavement. All water main valve box lids shall have the word “WATER” cast in the lid.
3. All reasonable effort must be made to locate valves/valve boxes, back of curb, in grass areas and at street corners, whenever possible.
4. Valve boxes in areas that will require sod at a later date must be left one to two inches above existing grade (to allow for sod thickness).

5. All valves must be centered over the operating nut and all valves, after being fully opened, will be backed off one-quarter turn to prevent them from being jammed open. This procedure should take place only after the main has passed pressure testing and has been certified by the Engineer.
6. Should the operating nut be more than three feet below the final grade, an extension shall be supplied and installed by the Contractor. The extension shall bring the nut to within twelve (12) inches of final grade.

D. Installing Valves on Existing Mains
1. When installing valves in existing mains (cutting-in), the Contractor shall insure that the pipe is kept clean at all times and no debris, ground water, mud, oil, etc., will make their way into the pipe.

E. Installation of Tapping Sleeves and Valves
1. Install the tapping sleeve and valve and pressure test prior to making the tap.
2. If leaks are present, the Contractor shall repair them to the satisfaction of the Engineer or Resident Project Representative.
3. Complete the tapping operation and close tapping valve.
4. Tapping valve shall not be opened until new main has been tested and certified for operation.

F. Hydrants
1. Each hydrant shall be connected to the main with a 6-inch branch line.
2. Hydrants shall be set with the pumper nozzle facing the roadway and with the center of the lowest outlet not less than 18 inches above the finished surrounding grade and the operating nut not more than 48 inches above the finished surrounding grade.
3. Set fire hydrants with safety flange not more than 6 inches and not less than 2 inches above grade.
4. The hydrant shall be set in a bed of # 57 stone which shall surround the barrel at least twelve (12) inches in all directions.
5. Hydrants and tees (runs and branches) shall be restrained using field-applied restraint system per CFPUA MSM.
6. Provide support blocking and drainage gravel while installing fire hydrants; do not block drain hole.
7. After main-line pressure testing, flush fire hydrants and check for proper drainage.

G. Thrust Restraints: As specified in Section 33 05 09.33 - Thrust Restraint for Utility Piping.
1. New main construction shall be restrained by means of field or factory applied systems as shown on the Engineer drawings.
2. Thrust blocks in new mains is prohibited except when directed by the Engineer.
3. Where a fitting or device is to be inserted into an existing main, thrust blocking shall be installed as directed by the Engineer or CFPUA.

H. Polyethylene (PE) encasement when indicated for ductile iron pipe and fittings:
1. Encase piping in PE as indicated on Drawings to prevent contact with surrounding soil material or insulation from adjacent cathodic protection system.
2. Comply with AWWA C105.
3. Where pipe exits ground, terminate encasement 3 to 6 inches above surface.

I. Pipe Locator Wire: Install per Section 33 01 12 - Identification for Utilities Piping.

J. Service Connections: As specified in Section 33 14 14 - Public Water Service Connections.

K. Disinfection of Potable Water Piping Systems: As specified in Section 33 14 20 - Disinfection of Water Distribution Mains.

L. Pipe Markers: According to CFPUA Details and Material Specification Manual.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 - Execution and Closeout Requirements.

B. Section 33 05 05.31 - Hydrostatic Testing.
   1. Pressure test piping system according to AWWA C600 and AWWA C605.

C. Section 33 14 20 - Disinfection of Water Pipelines, Facilities, and Appurtenances.

D. Pigging – Flushing and Cleaning Alternative for Large Mains
   1. For mains where flowrates cannot be achieved to create minimum cleaning velocities of 2 feet per second or greater, cleaning of the new piping system by pigging methods shall be established for the project by the Engineer. Pigging includes the following measures:
      a. Pig launching and retrieval equipment to minimize additional valves, fittings, and auxiliary water supplies.
      b. Valves and blowoff assemblies, which are installed as part of the project, shall be used as much as possible to minimize the number of temporary ports required for pigging.
      c. Pig materials used shall be specifically manufactured for flushing and cleaning pressure pipes, bends, and valves. The pigs shall be able to go through bends, open valves, and fittings, and provide adequate cleaning of the pipe.
      d. Pigging shall be accomplished by the controlled and pressurized passage of a series of hydraulic or pneumatic polyurethane plugs of varying dimensions, coatings, and densities.
      e. Pigs shall be selected by the Contractor and approved by the Engineer.
      f. The Contractor shall provide means to enter the pig into the system, control and regulate flow, monitor flows and pressures, and to remove the pig from the system.
      g. The Contractor shall maintain constant surveillance of the pig while active in the pipe system and immediately report problems encountered or any malfunctions discovered in the piping system.

END OF SECTION

SECTION 33 14 14

PUBLIC WATER SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe and fittings for water service connections to small commercial, light industrial, and residential homes 2” service and smaller.
   2. Corporation stop assemblies.
   3. Curb stop assemblies.
   4. Backflow preventers.
   5. Meter setting equipment.
   6. Meter boxes.
   7. Trenching, bedding, and cover.

B. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.
   3. Section 33 14 13 – Water Distribution Piping and Appurtenances.
   4. Section 33 14 13 – Water Distribution Valves and Fire Hydrants.
   5. Section 33 14 20 – Disinfection of Water Distribution Mains.
   6. Section 33 05 13 – Precast Concrete Manholes and Utility Structures.

C. CFPUA provides potable water service which may be interrupted for repairs, system expansion, or other general requirements. CFPUA does not guarantee adequate fire flow for protection of life or property. There shall be no domestic use taps allowed on a dedicated fire line. Some facility owners choose to utilize this interruptible potable water supply from the CFPUA system for fire protection. If facility owners choose to utilize the potable water system for fire protection flow, the service for fire protection shall be configured according to Part 3 of this Section.

1.2 REFERENCES

A. American Association of State Highway and Transportation Officials:
   1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. American Society of Mechanical Engineers:
   1. ASME B16.18 – Cast Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.22 – Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. American Society of Sanitary Engineering:
   1. ASSE 1012 – Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent.

2. ASSE 1013 – Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers.

D. ASTM International:
1. ASTM B62 – Standard Specification for Composition Bronze or Ounce Metal Castings.
2. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2737 - Standard Specification for Polyethylene (PE) Plastic Tubing.
5. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
6. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

E. American Welding Society:
1. AWS A5.8/A5.8M - Specification for Filler Metals for Brazing and Braze Welding.

F. American Water Works Association:
1. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
2. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances.
3. AWWA C800 – Underground Service Line Valves and Fittings.
4. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
5. AWWA M6 – Water Meters – Selection, Installation, Testing, and Maintenance.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Any event requiring a CFPUA representative to be present shall require a minimum of 2 business day notice to schedule the event.

B. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject to penalties in accordance with CFPUA's ordinance.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Informational Submittals:
1. Product Data: Submit manufacturer information regarding pipe materials, pipe fittings, corporation stop assemblies, curb stop assemblies, meters, meter setting equipment, service saddles, backflow preventers, and accessories.
2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
3. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

C. Action Submittals:
   1. Test Reports: Submit all the results of the bacteriological tests to the CFPUA Engineering Inspector.
   2. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
   3. Qualifications Statement:
      a. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Project Record Documents: Record actual locations of piping mains, curb stops, connections, thrust restraints, pressure-pipe centerline elevations, and gravity-pipe invert elevations.

C. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

B. Perform Work according to CFPUA standards and details.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

PART 2 PRODUCTS

2.1 MATERIAL SPECIFICATION MANUAL

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM No.	Product
A	Polyethylene Service Tubing
F	Service Saddles/ Hinged Type for 2” PVC
F	Service Saddles/ Brass Alloy/ Stainless Steel Straps for Cast, Ductile & PVC Pipe
F	Service Saddles/ Ductile Iron/ Stainless Steel Straps for Cast, Ductile & PVC Pipe
F	Service Saddles/ Ductile Iron/ Stainless Steel Straps for HDPE Pipe
F	Service Saddles/ Hinged Type for 2” HDPE
G	Inline Valves
G	Straight Couplings (3/4" X 1”)
G	Straight Couplings (1”)
G	Meter Setters (5/8" X 3/4" Meter)
G	Meter Setters (1" Meter)
G	Meter Setters (1 1/2"& 2” Meter)
G	Dual Service U-Branch (5/8" X 3/4" Meter)
G	Dual Service U-Branch (1" METER)
G	Curb Stop Assemblies
J	Meter Box (5/8”, 3/4", & 1”) Single Service Non-Traffic Areas
J	Meter Box (5/8”, 3/4", & 1”) Dual Service Non-Traffic Areas
J	Meter Box (5/8”, 3/4", & 1”) Single Service Traffic Rated
J	Meter Box (5/8”, 3/4", & 1”) Dual Service Traffic Rated
J	Meter Box (1 1/2", & 2”) Single Service Non-Traffic Areas
J	Meter Box (1 1/2", & 2”) Single Service Traffic Rated
J	Lid Details (5/8”, 3/4", & 1”) Single Service Non-Traffic Areas
J	Lid Details (5/8”, 3/4", & 1”) Dual Service Non-Traffic Areas
J	Lid Details (5/8”, 3/4", & 1”) Single Service Traffic Rated
J	Lid Details (5/8”, 3/4", & 1”) Dual Service Traffic Rated
J	Lid Details (1 1/2" & 2”) Single Service Non-Traffic Areas
J	Lid Details (1 1/2" & 2”) Single Service Traffic Rated
L	Tracer Wire (Solid Copper)
L	Direct Bury Wire Splice Kit

2.2 CURB STOP ASSEMBLIES

A. For ⅝-inch through 2-inch services provide a CTS inlet X Female iron pipe thread curb stop on CTS line 3” from inlet of meter setter.

2.3 WATER METERS SINGLE SERVICE

A. Meter box shall be installed flush with grade. Box shall be sized and centered around the meter assembly to allow for access and future maintenance.

2.4 DUAL SERVICE

A. Meter box shall be installed flush with grade. Box shall be sized and centered around the meter assembly to allow for access and future maintenance.

B. U-branch shall be installed prior to meter setter.

C. Meter setter shall be installed to allow three (3) to six (6) inches from top of meter from bottom of lid.

D. Meter setter shall be installed in the upright position.

2.5 MATERIALS

A. Bedding: As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

B. Cover: As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

C. Soil Backfill from Above Pipe to Finish Grade: As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Verify that building service connections and municipal utility water main sizes, locations, and inverts are as indicated on Shop Drawings.

3.2 PREPARATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.

C. Remove scale and dirt from inside and outside of piping before assembly.

3.3 INSTALLATION

A. 1-inch Service Corporation Stop Assemblies:
   1. Make connection for each different kind of water main, using suitable materials, equipment, and methods as approved by Engineer.
   2. Provide service clamps for mains constructed of materials other than cast iron or ductile iron.
   3. Location:
      a. Locate and stagger corporation stops at least 36 inches apart longitudinally.
   4. Plastic Pipe Mains:
      a. Provide full support for service clamp for full circumference of pipe, with minimum 2-inch width of bearing area.
      b. Exercise care against crushing or causing other damage to mains at time of tapping or installation of service clamp or corporation stop.

5. Use seals or other devices such that no leaks are present in mains at points of tapping.
6. Do not backfill and cover service connections until installation has been approved by Engineer and CFPUA inspector.

B. Bedding:
1. Excavate pipe trench as specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering, and Backfilling.
2. Placement:
   a. Place bedding material as indicated on Drawings.
   b. Level fill materials in one continuous layer not exceeding 8 inches of compacted depth.
   c. Compact to 95 percent maximum density.
3. Place fill materials as specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

C. Pipe and Fittings:
1. Maintain separation of water main from **sewer piping** according to code.
2. Group piping with other Site piping Work whenever practical.
3. Install pipe to allow for expansion and contraction without stressing pipe or joints.
4. Install access fittings to permit disinfection of water system.
5. Jointing of Pipe:
   a. Connections between different types of pipe and accessories shall be made with transition fittings approved by CFPUA's representative.
   b. Service laterals shall consist of a tapping saddle, corporation stop and a length of PE pipe with no joint installed between the main service tap and the service stop. Service laterals shall be installed perpendicular to the water main. Contractor shall install all material per the CFPUA Material Specification Manual allowing for meter installation at a later date by CFPUA personnel. Locator wire shall be installed as per specifications.
6. Thrust Restraints: Form and place concrete for thrust restraints at each elbow or change of direction of pipe.
7. Establish elevations of buried piping with not less than three (3) feet of cover.
8. Pipe Markers: According to CFPUA MSM.
9. Backfill trench as specified in Section 31 23 34.01 – Excavation, Trenching, Dewatering and Backfill for Pipes.

D. Curb Stop Assemblies:
1. Set curb stops on 95% compacted soil.

E. Water Meters: 2-inch and smaller shall be set by CFPUA.

F. Backflow Preventers:
1. Install backflow preventers where indicated on Drawings and according to manufacturer instructions.
2. Testing and Installation Requirements: Comply with CFPUA requirements and plumbing codes, see CFPUA's website under Departments, Environmental Management – Backflow and Cross Connections.

G. Service Connections:

1. Install water service according to as indicated on Drawings.
2. Install water service to 18” of right-of-way and connect to building water service as specified in CFPUA details and referenced in CFPUA Material Specification Manual.
3. All meters installed on lines greater than 2-inch diameter must have a strainer and be installed in an appropriately sized, approved meter vault that provides sufficient access for reading, maintenance, and protection in accordance with Water Meter Vaults specification.

H. Service Intended for Fire Protection:
1. Two taps shall be installed, one for potable water and one for fire flow. The potable water tap shall be installed and metered in accordance with this Section. The fire flow tap shall not be metered, and the fire flow system shall be fully segregated from the potable system throughout the facility. A valve will be installed at the tap and the right-of-way or easement line denoting the CFPUA owned/privately owned boundary. A privately owned, privately maintained backflow prevention device shall be installed in the line immediately after entering a structure in accordance with the North Carolina State Building Code and the CFPUA Cross Connection Control Ordinance.

I. Pipe Locator Wire: As specified in Section 33 01 12 – Identification for Utilities Piping.

J. Disinfection of Water Piping System: Flush and disinfect system as specified in Section 33 14 20 – Disinfection of Water Distribution Mains.

3.4 TOLERANCES

A. Install pipe to indicated elevation to within tolerance of 1-inch.

3.5 FIELD QUALITY CONTROL

A. Section 01 40 00 – Quality Requirements.

B. Pressure test water distribution system according to Section 33 05 05.31– Hydrostatic Testing of Water Distribution and Sanitary Sewer Force Mains.

C. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION

SECTION 33 14 20

DISINFECTION OF WATER PIPELINES, FACILITIES AND APPURTENANCES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Essential procedures for disinfecting new and repaired water mains. All new water mains, services, and appurtenances shall be disinfected before they are placed in service. All water mains taken out of service for inspection, repair, or other activities shall be disinfected before they are returned to service.
   2. Testing and reporting of results.

B. Each unit of constructed water main, services, and appurtenances shall be disinfected with chlorine upon successful completion of the hydrostatic test. The disinfection procedure shall be performed in strict conformance with Cape Fear Public Utility Authority (CFPUA) procedures for disinfecting water mains, as outlined in paragraphs 3.2 and 3.3 of this Section.

C. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 33 14 13 – Water Distribution Piping and Appurtenances.
   3. Section 33 14 14 – Public Water Service Connections.
   4. Section 33 14 13 – Water Distribution Valves and Fire Hydrants.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA B300 – Hypochlorites.
   2. AWWA C651 – Disinfecting Water Mains.
   3. AWWA M12 – Simplified Procedures for Water Examination.
   4. APHA, AWWA, WEF – Standard Methods for the Examination of Water and Wastewater.

B. North Carolina Public Water Supply:
   1. NCPWS Rules Governing Public Water Systems Section .1000 – Disinfection of Water Supply Systems.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Any event requiring a CFPUA representative to be present will require a two-business day notice to schedule the event.

B. No valves are to be operated unless a CFPUA representative is present. Any valves operated without a CFPUA representative present, or a directive may be subject to penalties in accordance with CFPUA's Ordinance.

C. The Contractor shall pay particular attention to the scheduling requirements outlined in the procedures. The Contractor shall be responsible for furnishing and installing all required chlorine injection and monitoring ports at no additional cost to CFPUA.

D. The mains will in no case be accepted by CFPUA for public use until the CFPUA Engineer approves the mains as having been properly disinfected.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittal Procedures.

B. Submittals:
   1. Product Data: Submit manufacturer information for proposed chemicals and treatment doses.
   2. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
   3. Disinfection Procedure: Submit description of procedure, including type of disinfectant and calculations indicating quantities of disinfectants required to produce specified chlorine concentration.
   4. Certify that final water complies with disinfectant quality standards of CFPUA.
   5. Test and Evaluation Reports: Indicate testing results comparative to specified requirements. All lab reports shall be from certified lab and submitted to CFPUA representative.
   6. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Disinfection Report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and completion.
   3. Test locations.
   4. Name of person collecting samples.
   5. Initial and 24-hour disinfectant residuals in treated water in ppm for each outlet tested.
   6. Date and time of flushing start and completion.
   7. Disinfectant residual after flushing in ppm for each outlet tested.

1.6 QUALITY ASSURANCE

A. Perform Work according to AWWA C651.

B. QUALIFICATIONS
   1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
   2. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals:
   1. Calcium hypochlorite: Comply with AWWA B300.
   2. Sodium hypochlorite: Comply with AWWA B300.

2.2 CHLORINE RESIDUAL TEST KITS

1. Test kits shall use methodology conforming with *Standard Methods for the Examination of Water and Wastewater* or AWWA Manual M12.
2. Manufacturers:
   a. Hach Company.
   b. LaMotte.
   c. Fisher Scientific.
   d. Hellige.
   e. Or equal.

PART 3 EXECUTION

3.1 PREVENTIVE AND CORRECTIVE MEASURES DURING CONSTRUCTION

Heavy particulates generally contain bacteria and prevent even very high chlorine concentrations from contacting and killing such organisms. It is, therefore, essential that the procedures of this section be observed to assure that a water main and its appurtenances are thoroughly clean for the final disinfection by chlorination. Also, any connection of a new water main to the active distribution system prior to receipt of satisfactory samples may constitute a cross-connection. Therefore, the new main must be isolated until all bacteriological and other tests are satisfactorily completed.

A. KEEPING PIPE CLEAN AND DRY: Precautions shall be taken to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material. All openings in the pipeline shall be closed with watertight plugs when work is stopped at the end of the day or for other reasons.

B. JOINTS: Joints of all pipes in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

C. PACKING MATERIAL: All packing material shall consist of molded or tubular rubber rings, or other approved material. Lead or asbestos material in any form shall not be permitted.

D. SEALING MATERIALS: No contaminated material or any material capable of supporting prolific growth of microorganisms shall be used for sealing or lubricating joints. Sealing and lubricating material or gaskets shall be handled in a manner that avoids

contamination. The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in closed containers and shall be kept clean. Soil conditions could warrant the upgrade of gasket material to a volatile resistant material.

E. CLEANING OF PIPE AND APPURTENANCES: If dirt enters the pipe, it shall be removed, and the interior pipe surface cleaned. If, in the opinion of the CFPUA representative, the dirt remaining in the pipe will not be removed by the flushing operation, then the interior shall be cleaned by mechanical means such as a hydraulically propelled foam pig or another suitable device. The cleaning method used shall not force mud or debris into the interior pipe joint spaces and shall be acceptable to CFPUA.

F. FLOODING BY STORM OR ACCIDENT DURING CONSTRUCTION: If the main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section of pipeline shall be flushed until water from the pipe runs clear.

3.2 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Chlorination Planning:
   1. Before calling the CFPUA office for a time to be set up for disinfection, all of the following shall be installed or supplied by the Contractor at no cost to CFPUA. This list shall be checked and/or assembled before the CFPUA Engineering personnel arrive.
      a. A valve may be required to be installed in the line to be disinfected near the CFPUA water main connection.
      b. A blowoff of a brass or approved material faucet may be required to be installed at the dead end of the line, at all closed valves, and every 1,200 feet to be disinfected for flushing purposes and bacteria sampling. The opening to this blowoff should point downward, and there should be at least twenty-four inches clearance between the opening and the ground for proper sampling.
      c. Mains connecting other mains with open valves within the system to be disinfected may cause “short circuits” resulting in improper disinfection. Valves on these connecting mains shall be checked to see if they should be closed to eliminate this problem. Blowoffs should be at both sides of valves closed to prevent “short circuits”.
      d. Successful hydrostatic testing and CFPUA acceptance of said testing of the line is required before disinfection procedures.
      e. A clean container shall be used to mix and/or dissolve the hypochlorite.
      f. A clean, new wooden mixer shall be present for mixing and dissolving the hypochlorite.
      g. A pump for pumping the chlorine solution into the line shall be present. This pump shall be gasoline or electrically powered chemical feed pump designed for feeding chlorine solutions. For small applications, the solutions may be fed with a hand pump, for example, a hydraulic test pump. Feed lines shall be of such material and strength as to withstand safely the maximum pres-

sures that may be created by the pumps. All connections shall be checked for tightness before the hypochlorite solution is applied to the main.

h. All temporary blowoffs and injection points shall be properly abandoned and physically disconnected when directed by CFPUA prior to the line being placed into service.

C. Verify that access fittings have been installed under Section 33 14 13 – Water Distribution Piping and Appurtenances.

D. Perform scheduling and disinfecting activity with startup, water pressure testing, adjusting, and balancing, and demonstration procedures, including coordination with related systems.

3.3 DISINFECTION PROCEDURE FOR NEW WATER MAINS AND FIRELINES

A. Provide required equipment to perform Work of this Section.

B. Method of Chlorination:

1. Use the continuous feed method for disinfection of all new water mains. This method must give a minimum of 10 mg/L of chlorine residual at the end of the 24-hr period.
   a. Continuous-Feed Method**:** The continuous-feed method is the process in which a concentrated solution of chlorine is injected into the water main. Caution shall be observed during the handling and injection of the chlorine solution as chlorine in any form is very toxic and any error could be harmful to the employees and to the public.
   b. Preliminary Flushing: Before chlorine solutions are injected, the main shall be filled with potable water to eliminate air pockets and shall be flushed to remove particulates. The flushing velocity in the main shall not be less than 3.0 ft/sec (preferably 3.5 ft/sec) unless the CFPUA representative determines that conditions do not permit the required flow or that the flow will cause undue problems when discharged to waste. An acceptable flushing velocity shall then be determined and used.
   c. Procedure for Chlorinating the Main:
      1) Water supplied from the existing distribution system or other Approved public water supply shall be made to flow at a constant, measured rate into the newly installed water main. In the absence of a meter, the rate may be approximated by Approved method.
      2) At a point, not more than 10 ft downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 50 mg/L and not greater than 100 mg/L free chlorine residual. To ensure that this concentration is provided, measure the chlorine concentration at regular intervals of distance and time in accordance with the procedures described in the current edition of *Standard Methods for the Examination of Water and Wastewater* or AWWA Manual M12, or by using Approved chlorine test kits.
      3) During the application of the chlorine, valves shall be adjusted by or under the supervision of the CFPUA representative to prevent the chlorine solution from entering the existing water system. The chlorine injection

shall not cease until the entire water main is filled with a chlorine concentration of not less than 50 mg/L. All appurtenances and valves shall be operated to ensure that the chlorine solution has contact with them. The chlorinated water shall be allowed to remain for a period of not less than 24-hours.

4) At the end of the 24-hour period, the chlorine residual shall be measured and shall not be less than 10 mg/L in any samples collected along the water main and at the end of said water main.

C. Final Flushing:

1. Clearing the Main of Highly Chlorinated Water: Highly chlorinated water shall not remain in prolonged contact with pipe. At the end of the 24-hour contact period, the water shall be removed in order to prevent damage to the pipe lining or corrosion damage to the pipe itself. The highly chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system.
2. Disposing of Highly Chlorinated Water: A neutralizing chemical shall be applied to the chlorinated water to be discharged to neutralize thoroughly the chlorine residual. Chlorine residual of water being disposed shall be neutralized by treating with one of the chemicals listed below:
   a. Ascorbic Acid
   b. Sodium Ascorbate
   c. Sulfur Dioxide
   d. Sodium Bisulfate
   e. Sodium Sulfite
   f. Sodium Thiosulfate

D. Bacteriological and Other Tests:

1. Standard Conditions: After final flushing and before the new main is opened to the distribution system, two consecutive sets of acceptable samples, taken at least 24-hours apart, shall be collected from the new main. Samples shall be collected from every 1,200-ft of new water main, from the end of the water line, and from each branch. All samples shall be tested in accordance with *Standard Methods for the Examination of Water and Wastewater*. All samples shall show the absence of coliform organisms, and a free chlorine residual equal to the level present in the existing system and shall have no visible color or particulate matter. **Must be submitted in the form of an official report by a certified lab.**
2. Special Conditions: If in the opinion of CFPUA, excess contamination has been allowed to enter the water main during construction or other events, bacteriological samples shall be taken at intervals of approximately 400 to 500 ft and shall be identified by location. Samples shall be taken of water that has stood in the new main for at least 16 hours after final flushing has been completed.
3. Sampling Procedures: Sample collection shall be in accordance with *Standard Methods for the Examination of Water and Wastewater*. A copper or PVC assembly or a combination blowoff and sampling tap may be used for mains up to 8-inches diameter. Fire hydrants may not be used for sampling purposes. After samples have been collected, analyzed, and accepted, the sampling assemblies may be removed and retained for future use. All bacteriological analysis must be completed by a N.C. certified Drinking Water laboratory. The utility contractor

shall be responsible for all costs associated with the sampling and analysis of all samples required for acceptance. **All Lab Reports shall be delivered to the CFPUA Representative before any activation can proceed.**

E. Replace permanent system devices that were removed for disinfection.

3.4 DISINFECTION PROCEDURE FOR REPAIRED WATER MAINS

A. The following procedures apply primarily when mains are wholly or partially dewatered. After the appropriate repair procedures have been completed, the existing main may be returned to service prior to completion of the bacteriological testing to minimize the time customers are out of water. Leaks or breaks that are repaired with clamping devices while the mains remain full of water under pressure present little danger of contamination and require no disinfection.

B. The following procedure is considered as a minimum that may be used.
   1. Swabbing with Hypochlorite Solution: The interior of all pipe and fittings used in making repair (particularly couplings and tapping sleeves) shall be swabbed with a five (5) percent hypochlorite solution (300 mg/l concentration) before they are installed.
   2. Flushing: Thorough flushing is the most practical means of removing contamination introduced during repairs. If valve and hydrant locations permit, flushing toward the work location from both directions independently is recommended. Flushing shall be started as soon as the repairs are completed and shall be continued until discolored water and particulate matter are eliminated.
   3. Slug Chlorination: When practical, in addition to the procedures above, the section of main in which the break is located shall be isolated, all service connections shut off, and the section flushed and chlorinated with a high concentration of chlorine (as much as 300 mg/L), and the concentration allowed to stay in contact with the main for a minimum of 15 minutes. After chlorination, flushing shall be resumed and continued until discolored water is eliminated and the water is free of noticeable high chlorine odor. A chlorine residual of no greater than 3.0 mg/L shall be acceptable.
   4. Sampling: Bacteriological samples shall be taken after repairs are completed to provide a record for determining the procedure's effectiveness. If the direction of flow is known, sample locations shall be determined. If the direction of flow is unknown, then samples shall be taken on each side of the main break. If bacteriological samples are unacceptable, the CFPUA representative shall determine corrective action. Daily sampling shall be continued until two successive daily samples are acceptable.

3.5 REPEAT DISINFECTION OF WATER MAIN

A. If the initial disinfection fails to produce satisfactory results as per specifications, the new main shall be reflushed, rechlorinated and resampled; CFPUA may also require further cleaning methods (i.e., pigging the line) if the disinfection fails twice. If check samples also fail to produce acceptable results, the new main shall be reflushed and rechlorinated by the continuous-feed method of chlorination until satisfactory results are obtained.

B. High velocities in the existing system, resulting from flushing the new main may disturb sediment that has accumulated in the existing mains. When check samples are taken, it is advisable to also sample water entering the new main.

3.6 CONNECTION TO EXISTING SYSTEM

A. The NCPWS certifications, final acceptance, opening of valves and activation of the existing water system will only be allowed after satisfactory samples and chlorine levels have been produced. All sampling devices and blowoffs must be removed from the water main by the contractor prior to acceptance by CFPUA. The CFPUA Operations Department will activate the system when their procedures are completed.

3.7 FIELD QUALITY CONTROL

A. Section 01 70 00 – Execution and Closeout Requirements.

END OF SECTION

SECTION 33 31 11

SANITARY SEWER GRAVITY MAINS

PART 1 GENERAL

1.1 DESCRIPTION

A. Section Includes Installation of:
   1. Pipe and fittings for sewer gravity mains.
   2. Gasket materials, couplings and other gravity main appurtenances.

B. Related Requirements:
   1. CFPUA Material Specification Manual (MSM).
   2. Section 01 50 00 – Bypass Pumping.
   3. Section 03 05 00 – Concrete.
   4. Section 31 23 34 – Excavation, Trenching, Dewatering and Backfilling.
   5. Section 33 01 12 – Identification for Utilities Piping
   6. Section 33 14 22 – Testing of Gravity Sewer Mains and Manholes.
   7. Section 33 05 13 – Precast Concrete Manholes and Utility Structures.
   8. Section 33 05 07.13 – Utility Horizontal Directional Drilling.
   9. Section 33 05 07.23 – Jacking and Boring Pipe Construction.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
   2. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   3. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   4. AWWA C116 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray Iron Fittings.
   5. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast.
   6. AWWA C153 – Ductile-Iron Compact Fittings.
   7. AWWA C600 – Installation of Ductile Iron Mains and Their Appurtenances.
   8. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.
   9. AWWA C900 – Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. for Water Transmission and Distribution.
   10. AWWA C906 – Polyethylene Pressure Pipe and Fittings, 4-In. Through 65-In. for Waterworks.

B. ASTM International:
   1. ASTM D698 – 12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
   2. ASTM D1557 – 12e1 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
   3. ASTM D1785 – Standard Specification for Poly (Vinyl Cloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

4. ASTM D2241 – Standard Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
5. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
6. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Section 01 30 00 – Administrative Requirements

B. Coordination:
   1. Coordinate Work of this Section with connection to CFPUA and trenching.
   2. The existing system must be kept in operation at all times. Where connections are made to existing mains or other shutdowns are necessary, permission must be obtained and arrangements must be made with the CFPUA Wastewater Collections ORC, Utility Services Division for removing from service those mains that will be affected.
   3. Notify CFPUA no less than two business days prior to an event requiring a CFPUA representative to be present.
   4. The Contractor shall, at least two (2) business days in advance, notify citizens subject to interruption of service by means of door hangers or any other approved method of the starting time and duration of such interruption.
   5. Bypass pumping and hauling operations may be required to interrupt service. A bypass pumping plan shall be submitted in accordance with Section 01 50 00 – Bypass Pumping. Shutdowns must be held to a minimum in both number and duration.

1.4 SUBMITTALS

A. Section 01 33 00 – Submittals: Requirements for submittals.

B. Product Data/Source Quality:
   1. Manufacturer’s literature and specifications, as applicable, for products specified in this Section.
   2. Shop test results and inspection data, certified by manufacturer.

C. Testing Procedures:
   1. Submit proposed testing procedures, methods, apparatus, and sequencing. Obtain ENGINEER’s approval prior to commencing testing.

D. Manufacturer Instructions:
   1. Submit manufacturer's instructions for handling, storing, and installing pipes and appurtenances.

E. Manufacturer Certificates:
   1. Certificates of compliance with referenced standards, where applicable, including those of AWWA and others required by Engineer.

F. Field Quality Control Submittals:
   1. Results of Contractor furnished testing and inspections.

1.5 CLOSEOUT SUBMITTALS

A. 01 70 00 – Execution and Closeout Requirements

B. Project Record Documents:
   1. Maintain accurate and up-to-date record documents showing modifications made in the field, in accordance with approved submittals, and other Contract modifications relative to buried piping Work.

   2. Record actual locations and elevations of piping mains, valves, hydrants, manholes, service laterals, cleanouts, connections, thrust restraints, and other utilities found and not indicated on design plans.

C. Operations and Maintenance Data:
   1. Furnish in operations and maintenance manuals complete data for materials in accordance with 01 60 00 - Product Requirements.

1.6 QUALITY ASSURANCE

A. Qualifications: Company specializing in manufacturing products specified in the CFPUA Materials Specification Manual.

B. Perform Work according to AWWA and PVC Pipe Association standards.

C. The bell ends of pipe shall face the direction of laying unless otherwise directed by the Engineer, for lines on appreciable slope, the Engineer may require that bell ends face upgrade.

D. All stainless-steel fasteners shall be 316.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 – Product Requirements.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Storage:
   1. Store materials according to manufacturer instructions.
   2. Block individual and stockpiled pipe lengths to prevent moving.
   3. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
   4. Store PE and PVC materials out of sunlight.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.8 SITE CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.
   3. A minimum of ten-foot utility easement must be provided along the frontage of all lots and as shown for new developments.

1.9 WARRANTY

1. Section 01 70 00 – Execution and Closeout Requirements.

PART 2 PRODUCTS

2.1 CFPUA MATERIALS SPECIFICATION MANUAL

A. Refer to CFPUA Material Specification Manual (MSM) for the following products:

MSM Section	Material
A	Pipe
B	Fittings and Accessories
C	Joint Restraints
I	Castings & Aluminum Access Covers
K	Miscellaneous
L	Electrical
M	Coatings and Sealants
N.	Concrete

2.2 MATERIALS & ACCESSORIES

A. Bedding, Cover, and Backfill:
   1. As specified in Section 31 23 34.01 – Excavating, Trenching, Dewatering and Backfilling.

B. Manholes:

   1. As specified in Section 33 05 13 – Precast Concrete Manholes and Utility Structures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Identify required lines, levels, contours, and datum locations.

C. Determine exact location and size of water mains, valves, hydrants, and appurtenances from Drawings.

D. Verify location and elevation of existing facilities prior to excavation and installation of proposed gravity sewer mains and services.

3.2 PREPARATION

A. Section 01 35 00 – Special Procedures
   1. Pre-construction Site Audio/Video Inspections and Photography:
   2. Show mailboxes, curbing, lawns, driveways, signs, culverts, and other existing Site features.

B. Section 01 70 00 – Execution and Closeout Requirements.

C. All materials, unless otherwise directed, shall be unloaded as nearby as possible to the location of installation by the Contractor. Materials shall be handled with care to avoid damage.

D. All materials found during the progress of work to have flaws, cracks, or other defects will be rejected by the Engineer regardless of whether or not it has been installed and shall be replaced by and at the expense of the Contractor.

E. All PVC pipe, upon delivery to the site and until such time as it is placed in the trench, shall be shielded from the weather and direct sunlight to prevent pipe deterioration.

F. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surfaces, interior linings and components. If any part of the coating, lining or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer prior to attempting installation.

G. Pipe Cutting:
   1. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
   2. Use only equipment specifically designed for pipe cutting; use of chisels or hand saws is not permitted.
   3. Grind edges smooth with beveled end for push-on connections.

H. Remove scale and dirt on inside and outside before assembly.

3.3 INSTALLATION

A. Placement: As specified in Section 31 23 34.01 – Trenching, Excavation, Dewatering and Backfilling.
   1. All mains shall be laid and maintained at the required lines and grades with fittings and appurtenances at the described locations. All pipe shall be laid to the depth as shown on the drawings, or when a depth is not indicated, with a minimum cover of thirty-six (36) inches unless otherwise shown or approved by engineer. Grade lines shall be set by the Contractor. Realignments must be approved by the

Engineer. The Contractor shall have suitable survey equipment on the site at all times.

2. After placement in the trench the spigot end of the pipe shall be centered in the bell and the pipe shall be driven home and then brought to the proper line and grade by tamping approved backfill material under it, except for the bell. Joint deflection shall not exceed manufacturer's limit.
3. The Work shall at all times progress with caution so as to prevent damage to underground obstructions both known and unknown. Should an obstruction not shown on the drawings be encountered, the Engineer shall be immediately notified, and he shall be responsible for alteration to the design should realignment be necessary. Notify the Engineer far enough in advance to allow the realignment to be accomplished by deflection in the pipe joints.

B. Pipe and Fittings
1. Handle and assemble pipe according to manufacturer instructions.
2. Install pipe and fittings in strict conformance with AWWA C600 and C605.
3. Joint Deflection: Maximum joint deflection shall meet requirements of AWWA C600, C605 or AWWA Manual of Practice M23.
4. Prevent foreign material from entering pipe during placement and Work stoppages using plugs designed for that purpose. If trench contains standing water in joining zone, plug shall remain in place until the trench has been pumped dry before proceeding pipe laying.
5. Allow for expansion and contraction without stressing pipe or joints.
6. Solvent epoxy cementing, electro-fusion couplings and mechanical joining with bolt on wrap around clamps or mechanical joints without an adapter shall not be used for connections.

C. Push-On Joints
1. The inside of the bell and the outside of the spigot end shall be thoroughly cleaned to remove dirt, grit, oil or excess coatings and other foreign matter. For ductile iron pipe, the gasket shall be flexed inward and inserted in the gasket recess of the bell socket.
2. A thin film of gasket lubricant shall be applied to either the inside surface of the gasket or the spigot ends, care will be taken to avoid contact with the ground.
3. The joint shall be completed by forcing the plain end to the bottom of the socket with a forked tool or jacking device or other approved method. All pipe shall have depth mark prior to insertion. Pipe cut in the field shall be filed to resemble the spigot end of manufactured pipe.
4. When deflection is required the joint shall be completed prior to setting the deflection. The deflection shall conform to applicable AWWA Standards or manufacturer's recommendation.

D. Mechanical Joints
1. The inside of the socket, the outside of the spigot end and the gland shall be thoroughly cleaned and or washed with an approved solution to remove dirt, grit, oil or excess coatings and foreign matter to improve gasket seating.
2. The gland shall then be placed on the plain end of the pipe with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end of the pipe.

3. The pipe shall be inserted into the socket and the gasket pressed firmly and evenly into the gasket recess. The joint shall be kept straight during the assembly and any deflection required shall be done after the joint has been assembled but prior to tightening the bolts.

E. Polyethylene Encasement
1. Polyethylene (PE) encasement when indicated for ductile iron pipe and fittings:
2. Encase piping in PE as indicated on Drawings to prevent contact with surrounding soil material or insulation from adjacent cathodic protection system.
3. Comply with AWWA C105.

F. Transition from One Type of Pipe to Another
1. Provide necessary adapters, special, and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
2. Sewer service laterals shall be connected in accordance with Cape Fear Public Utility Authority Standard Drawing Details.
3. No flexible couplings shall be used.

G. Pipe Restraint
1. Provide restraint on ductile iron piping systems where shown or indicated in the Contract Documents below but not limited to:
    a. All ductile iron pipe aerial crossings and carrier pipes with any joints supported on pier or inside an encasement pipe shall require the use of a rigid joint restraint.
    b. All ductile iron pipe carrier pipes installed with joints inside an encasement pipe must utilize rigid restrained joints.

H. Service Connections
1. In new sewer construction, PVC service connections shall be made by means of a wye, DIP service connections shall be made by means of a wye or a tee. All joints connected to the wye unit shall remain flexible.
2. Service pipe for all properties shall be laid to the property line and plugged, as shown on the Standard Details. All sewer services shall be installed perpendicular to the main and terminate at the Right-Of-Way line. Sewer services in Cul-De-Sacs are required to be perpendicular or must originate in end of line manhole and terminate at Right-of-Way, no acute angles to downstream main.
3. All services tying into ductile iron mains shall be constructed of class 50, DIP with Protecto 401 ceramic epoxy lining.
4. Cleanouts shall be located a minimum of 6 feet from all property corners. Water meter boxes are to be a minimum of 5 feet from the property corner.
5. In cases of extra depth where service pipe cannot be laid on a continuous grade to the property line, the Contractor shall construct risers as shown on the Plans. When pipe cannot be adequately supported on undisturbed earth, it shall be supported on a concrete cradle.
6. Trench and backfill or bore to install lateral. Bore shall accommodate pipe without void around pipe. Bore shall be at least 5’ from the edge of pavement or back of curb on either side of the roadway unless approval to the contrary is given by the engineer.
7. Connect lateral with wye.

8. Install sewer lateral with plug and one-way clean-out. Clean-out shall consist of a ¼ bend long sweep, with the necessary vertical 4" Schedule 40 PVC/DWV pipe stack. The clean-out plug shall be installed into a cast iron box and cover.

I. Service Reconnections
   1. Service reconnections require adapters for all joints that will not connect properly with ordinary factory joints. Approved pipe cutting methods shall be used to cut any pipe required for the connection. No mortar or collars shall be used on reconnections unless specifically approved by the Engineer.
   2. No flexible couplings shall be used.

J. Joining New Pipe to Old Pipe
   1. Joining PVC pipe to existing vitrified clay pipe requires an adapter approved in the Cape Fear Public Utility Authority's Materials Specification Manual for all joints that will not connect properly with ordinary factory joints. Approved pipe cutting methods must be used to cut any pipe required for the connection. No mortar or collars shall be used for such connections unless approved by the Engineer.
   2. No flexible couplings shall be used.

K. Joining Pipe to Manholes or Other Structures
   1. All manhole connection holes shall be core drilled with a maximum hole diameter not to exceed one and a half times the pipe diameter.
   2. Approved standard groutable PVC-to-manhole fitting approved in the Cape Fear Public Utility Authority's Materials Specification Manual, or a flexible rubber boot may also be used at the manhole connection. The connection at the manhole wall shall be flexible and watertight. Any annular space inside the manhole at the connection shall be filled with approved caulking material or joint filler.
   3. Pipe connections to existing manholes shall be made so that finished work will conform, as nearly as possible to the essential requirements for new manhole construction, as specified above. Drop connections on existing manholes ***shall be strengthened by use of eight #6 pins***, placed around the drop elbow and tee, or inside PVC drops may be used.
   4. Provide a minimum of six (6) inches of separation between edge of manhole core holes and manhole barrel joints. Provide a minimum six (6) inches separation between edges of core holes. Coring the manhole cone section is not allowed.

L. Sewer Manhole Inserts
   1. Sewer manhole inserts are required at all manholes. Stainless steel sewer manhole inserts are required at manholes located in traffic areas.

M. Pipe Markers: According to CFPUA Details and Material Specification Manual.

3.4 FIELD QUALITY CONTROL

A. Section 01 70 00 – Execution and Closeout Requirements.

B. Section 33 14 22 – Testing of Sanitary Sewer Mains and Manholes.

END OF SECTION

SECTION 33 49 13
MANHOLES AND COVERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.
B. Masonry manhole sections with masonry transition to lid frame, covers, anchorage, and accessories.

1.02 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.
B. Section 04 20 00 - Unit Masonry Assemblies: Masonry units and mortar and grout.

1.03 UNIT PRICES - MEASUREMENT AND PAYMENT

A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.
B. Manhole: By the unit. Includes excavating, concrete base pad, concrete manhole sections, FRP manhole sections, brick masonry manhole construction, brick masonry transition to cover frame, cover frame and cover, to indicated depth, forming and sealing pipe inlets and outlets.

1.04 REFERENCES

A. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2005.
B. ASTM A 48/A 48M - Standard Specification for Gray Iron Castings; 2003.
C. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
D. ASTM C 55 - Standard Specification for Concrete Brick; 2003.
E. ASTM C 62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2005.
F. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2006a.
G. ASTM C 478M - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2006a.
H. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals; 2002.
I. ASTM C 923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals; 2002.
J. ASTM D 3753 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells; 2005.
K. IMIAWC (CW) - Recommended Practices & Guide Specifications for Cold Weather Masonry Construction; International Masonry Industry All-Weather Council; 1993.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with resilient connectors complying with ASTM C 923 (ASTM C 923M).
B. Concrete: As specified in Section 03 30 00.
C. Concrete Brick Units: As specified in Section 04 21 13.
D. Mortar and Grout: As specified in Section 04 20 00, Type S.
E. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.

2.02 CONFIGURATION

A. Shaft Construction: Concentric with concentric cone top section; lipped male/female dry joints; sleeved to receive pipe sections.
B. Shape: Cylindrical.
C. Clear Inside Dimensions: As indicated.
D. Design Depth: As indicated.
E. Clear Lid Opening: As indicated.
F. Pipe Entry: Provide openings as indicated.
G. Steps: As indicated.
H. Steps: As required by code.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.
B. Verify that built-in items are in proper location, and ready for roughing into Work.
C. Verify excavation for manholes is correct.

3.02 MANHOLES

A. Place concrete base pad, trowel top surface level.
B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.
C. Form and place manhole cylinder plumb and level, to correct dimensions and elevations. As work progresses, build in fabricated metal items.
D. Cut and fit for pipe.
E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
F. Coordinate with other sections of work to provide correct size, shape, and location.

3.03 MASONRY WORK

A. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
B. Lay masonry units in running bond. Course one unit and one mortar joint to equal 8 inches.
C. Form concave mortar joints.
D. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
E. Install joint reinforcement 16 inches on center.
F. Place joint reinforcement in first and second horizontal joints above base pad and below lid frame opening.

END OF SECTION 33 49 13