Town Creek Middle School

Winnabow, NC

Project No. 1720601.00

BRUNSWICK COUNTY SCHOOLS

CONSTRUCTION DOCUMENTS SUBMITTAL

May 24, 2018

PROJECT MANUAL

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PROJECT MANUAL
INCLUDING SPECIFICATIONS FOR

TOWN CREEK MIDDLE SCHOOL

BRUNSWICK COUNTY SCHOOLS

6330 LAKE PARK DRIVE SE
WINNABOW, NORTH CAROLINA 28479

PROJECT NO. 1720601.00

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END OF SECTION

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A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of the Contract Documents, as follows:

B. Geotechnical Reports: Entitled Geotechnical Engineering Report - Town Creek Elementary/Middle School, dated December 20, 2017, Geotechnical Engineering Addendum Letter, dated January 8, 2018 and Geotechnical Engineering Letter - TCMS Fire Lane, dated March 9, 2018 are included in the Project Manual.
   1. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
   2. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.
   3. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Sum accruing to Owner.

C. Liquefaction Potential Evaluation - Town Creek Middle School, dated February 8, 2018 is included in the Project Manual.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION





ECS Southeast, LLP

Geotechnical Engineering Report

Town Creek Elementary/Middle School

6330 Lake Park Dr. SE
Winnabow, North Carolina

ECS Project Number # 22:25758

December 20, 2017

ECS SOUTHEAST, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities
NC Registered Engineering Firm F-1078
NC Registered Geologists Firm C-406
SC Registered Engineering Firm 3252

December 20, 2017

Mr. Craig Eckert
Brunswick County Schools
35 Referendum Drive
Bolivia, North Carolina 28422

ECS Project No. 22:25758

Reference: Geotechnical Engineering Report
Town Creek Elementary/Middle School
6330 Lake Park Dr. SE
Winnabow, Brunswick County, North Carolina

Dear Mr. Eckert:

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 Proposal No. 22:2699R1-GP, dated November 21, 2017. This report presents our understanding of the geotechnical aspects of the project, the results of the field exploration conducted, and our design and construction recommendations.

It has been our pleasure to be of service to Brunswick County Schools 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 the assumptions of subsurface conditions made 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

Mike Ellis, E.I.
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Appendix C – SHWT and Infiltration Test Report

- SHWT and Infiltration Report

Appendix D – Supplemental Report Documents

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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 planned development included twenty three (23) electronic cone penetration test (CPT) soundings, twelve (12) Kessler dynamic cone penetrometer (DCP) tests, and eight (8) hand augers with seasonal high water table (SHWT) estimations and infiltration tests.

- The soundings generally encountered coastal plain soils consisting of Silty and Clean SAND (SM, SP), Sandy SILT (ML), Silty CLAY (CL-ML), Lean CLAY (CL), and Fat CLAY (CH).

- It is important to note that the natural geology at the site may have been modified in the past. Therefore, potential fill and unsuitable materials may be present at the site.

- The proposed building can be supported with a shallow foundation having an allowable bearing pressure of 2,000 psf. Undercutting in the upper two to four feet should be expected in the vicinity of soundings S-5, S-8, S-9, S-11, S-12, S-17, and S-18 through S-22.

- Based on the results of the CPT soundings and our evaluation of the site, liquefiable soils are present and it shall be assigned a seismic class “F”.

- The SHWT and Infiltration Report is presented in Appendix C of this report.

1.0 INTRODUCTION

1.1 GENERAL

ECS' understanding of this project is based on information provided by Mr. Craig Eckert of Brunswick County Schools. The site is located near 6300 Lake Park Dr. SE in Winnabow, Brunswick County, North Carolina. The project will consist of constructing a middle school with a gross square footage of approximately 90,000 square feet. Additionally, the project will consist of expanding the existing elementary school. We understand that associated drive and parking areas will be constructed north of the proposed middle school.

This report contains the results of our subsurface explorations, site characterization, engineering analyses, and recommendations for the design of the proposed construction.

1.2 SCOPE OF SERVICES

To obtain the necessary geotechnical information required for design of the proposed development, a total of twenty three (23) CPT soundings were performed. CPT soundings S-1 through S-13 and S-15 through S-23 were advanced to approximately 25 feet beneath the ground surface. CPT sounding S-14 was advanced to a refusal depth of approximately 34.3 feet beneath the ground surface. Shear wave velocity tests were performed in sounding S-14 for seismic site classification and liquefaction potential.

This report discusses our exploratory and testing procedures, presents our findings and evaluations and includes the following:

- 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 area and site geologic 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;
- Pavement design recommendations;
- Discussion of groundwater impact;
- Compaction recommendations;
- Special conditions encountered;
- Seismic site classification and liquefaction potential;
- Site vicinity map;
- Exploration location plan; and
- CPT sounding logs.

1.3 AUTHORIZATION

Our services were provided in accordance with our Proposal No. 22.21699R1-GP, dated October 3, 2017, as authorized by Brunswick County Schools on December 7, 2017, and includes the Terms and Conditions of Service outlined with our proposal.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION

The site is located at 6300 Lake Park Dr. SE in Winnabow, Brunswick County, North Carolina. Figure 2.1.1 below shows an aerial image of the site.



Figure 2.1.1 Site Location

2.2 CURRENT SITE CONDITIONS

The site consists of an existing elementary school and ranges from open to moderately wooded. Typical site elevations range from around 26 to 35 feet.

2.3 PROPOSED CONSTRUCTION

The project will consist of expanding the existing elementary school and constructing a new, 90,000 square foot middle school. We understand that associated drive and parking areas will be constructed north of the proposed middle school.

2.3.1 Site Civil Features

- Grading for stormwater ponds, roadways and building pads
- Cuts and fills less than 3 feet (assumed)

2.3.2 Structural Information/Loads

Structural loading information was provided by Mr. Jeff Troutman, P.E. of Criser Troutman Tanner Consulting Engineers. The following information explains our assumed structural loads for the purpose of the recommendations made in this report:

Table 2.3.2.1 Design Values

SUBJECT	DESIGN INFORMATION / EXPECTATIONS
Usage	School
Column Loads	50 to 86 kips
Wall Loads	3 to 6 kips/ft
Finish Floor Elevation	±3 feet of existing grade (assumed)

3.0 FIELD EXPLORATION

3.1 FIELD EXPLORATION PROGRAM

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms and to evaluate subsequent field data to assist in the determination of geotechnical recommendations.

3.1.1 Cone Penetrometer Soundings

The subsurface conditions were explored by drilling twenty three (23) electronic cone penetration test (CPT) soundings within the proposed building areas. CPT sounding S-14 was advanced to a refusal depth of approximately 34.3 feet beneath the existing ground surface.

Sounding locations were located in the field by an ECS representative using a hand held GPS unit and referencing existing site features. The approximate as-drilled sounding location is shown on the Exploration Location Diagram in Appendix A.

The CPT soundings were conducted in general accordance with ASTM D 5778. The cone used in the soundings has a tip area of 10 cm^2 and a sleeve area of 150 cm^2. The CPT soundings recorded tip resistance and sleeve friction measurements to assist in determining pertinent index and engineering properties of the site soils. The ratio of the sleeve friction to tip resistance is then used to aid in assessing the soil types through which the tip is advanced. The results of the CPT soundings are presented in Appendix B.

Within sounding S-14, seismic tests were performed at approximately three foot intervals to refusal to measure the shear wave velocity (v_s) of the subsurface materials to aid in assessing the dynamic response properties of the site subsurface materials. The seismic shear waves are generated by making impact with a 20-pound sledgehammer onto a steel beam. The impacts are initiated on the right and left sides of the CPT rig and the corresponding wave traces recorded on an oscilloscope are analyzed to determine the shear wave velocity of the tested material. The waves are measured with three geophones that are installed in the cone. The results of the CPT soundings are presented in Appendix B.

3.1.2 Direct Push Borings

ECS explored the proposed stormwater pond areas by advancing three (3) direct push borings to a depth of approximately 16 feet below the existing subgrade at the site. The approximate boring locations are shown on the attached Exploration Location Diagram.

The direct push boring method obtains continuous soil samples by driving four foot long sample tubes by means of a percussion hammer. The sample tubes are returned to the ECS soils laboratory in Wilmington, North Carolina and are visually classified according to the Unified Soil Classification System (USCS).

The direct push Boring Logs in Appendix B contain detailed information recorded at each of the boring locations.

3.1.3 Kessler Dynamic Cone Penetrometer Tests

Twelve (12) Kessler Dynamic Cone Penetrometer (DCP) tests were performed in the proposed pavement areas. The Kessler DCP is used to estimate the strength characteristics of soils. The Kessler DCP was continuously driven approximately 2 feet below the existing ground surface. The Kessler DCP is driven into the soil by dropping a Dual-Mass 17.6 lb Hammer from a height of 22.6 inches. The depth of cone penetration is measured at selected penetration or hammer drop intervals and the soil shear strength is reported in terms of the Kessler DCP index. The Kessler DCP index is based on the average penetration depth resulting from one blow of the 17.6 lb hammer. The Kessler DCP index can be correlated to CBR and modulus of rigidity. The individual results of the Kessler DCP tests are presented in Appendix B.

3.2 REGIONAL/SITE GEOLOGY

It is important to note that the natural geology at the site may have been modified in the past. Therefore, potential fill and unsuitable materials may be present at the site. 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.

Based on the U.S. Geological Survey[1,2] the proposed construct site lies within the Waccamaw Formation (Tpyw). Soils in the Waccamaw Formation typically contain alluvial silty sands and clays with shells. An overview of the general site geology is illustrated in Figure 3.2.1 below.

[1] The North Carolina Dept. of Environment, Health, and Natural Resources, Division of Land Resources, NC Geological Survey, in cooperation with the NC Center for Geographic Information and Analysis, 1998, Geology - North Carolina (1:250,000), coverage data file geol250. The data represents the digital equivalent of the official State Geology map (1:500,000 scale), but was digitized from (1:250,000 scale) base maps.

[2] Rhodes, Thomas S., and Conrad, Stephen G., 1985, Geologic Map of North Carolina: Department of Natural Resources and Community Development, Division of Land Resources, and the NC Geological Survey, 1:500,000-scale, compiled by Brown, Philip M., et al, and Parker, John M. III, and in association with the State Geologic Map Advisory Committee.

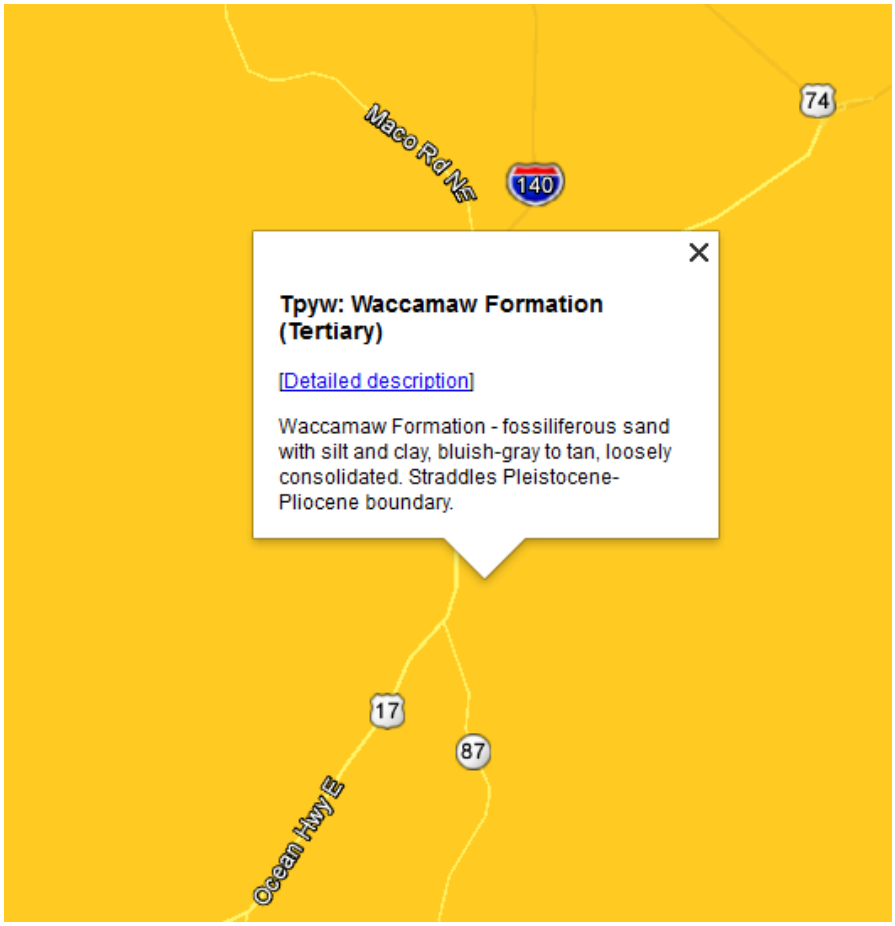


Figure 3.2.1

Geologic map for Figure 3.2.1 obtained from The North Carolina Dept. of Environment, Health, and Natural Resources, Division of Land Resources, NC Geological Survey, in cooperation with the NC Center for Geographic Information and Analysis, 1998, Geology - North Carolina (1:250,000), coverage data file geol250 and Google Earth.

3.3 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil encountered during our subsurface exploration. For subsurface information at a specific location, refer to the CPT Sounding Logs in Appendix B.

Table 3.3.1 Subsurface Stratigraphy

Approximate Depth Range (ft)	Stratum	Description	Ranges of N*-Values[(1)] blows per foot (bpf)
0-0.5	N/A	Soundings performed throughout contained an observed thickness of topsoil. Deeper topsoil or organic laden soils are most likely present in wet, poorly drained areas and potentially unexplored areas of the site.	N/A
0.5-6.0	I	Loose to Dense, Silty and Clean SAND (SM, SP) with interbedded layers of Very Soft to Stiff, Sandy SILT (ML), Silty CLAY (CL-ML) and Lean CLAY (CL), Moist to Wet	2 to 42
6.0-18.0	II	Very Soft to Firm, Sandy SILT (ML), Silty CLAY (CL-ML), Lean CLAY (CL) and Fat CLAY (CH) with interbedded layers of Loose to Medium Dense Silty and Clean SAND (SM, SP), Wet to Saturated	0 to 17
18.0-34.0	III	Loose to Very Dense, Silty, and Clean SAND (SM, SP), Saturated	5 to 50+
34.0	IV	LIMESTONE	100+

Notes: (1) Equivalent Corrected Standard Penetration Test Resistances

3.4 GROUNDWATER OBSERVATIONS

Porewater pressure measurements were made at the sounding locations during exploration as noted on the CPT sounding logs in Appendix B. The apparent groundwater depths were observed at the time of drilling to range from approximately 3.0 to 10.5 feet below ground surface.

The highest groundwater observations are normally encountered in the late winter and early spring. 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 not immediately apparent at the time of this exploration. If long term water levels are crucial to the development of this site, it would be prudent to verify water levels with the use of perforated pipes or piezometers.

4.0 DESIGN RECOMMENDATIONS

4.1 BUILDING DESIGN

The following sections provide recommendations for foundation design.

4.1.1 Foundations

Deep Foundations: Provided that the subgrades are prepared as discussed herein, the proposed elementary school expansion and new middle school can be supported by conventional shallow foundations. Undercutting in the upper two to four feet should be expected in the vicinity of soundings S-5, S-8, S-9, S-11, S-12, S-17, and S-18 through S-22. The design of the foundation shall utilize the following parameters:

Table 4.1.1.1 Foundation Design

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure[1]	2,000 psf	2,000 psf
Acceptable Bearing Soil Material	Stratum I	Stratum I
Minimum Width	30 inches	18 inches
Minimum Footing Embedment Depth (below slab or finished grade)	12 inches	12 inches
Estimated Total Settlement	1 inch	1 inch
Estimated Differential Settlement	Less than 0.5 inches	Less than 0.5 inches

1. Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.

It will be important to have the geotechnical engineer of record observe the foundation subgrade prior to placing foundation concrete; to confirm the bearing soils are what was anticipated. 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 structural fill. The depth and lateral extent of the undercut should be determined in the field during undercutting operation. An ECS representative must be on site during the undercut and backfill of the areas in order to provide a report stating that the repairs were in accordance with our recommendations.

4.1.2 Floor Slabs

Assuming the lowest finished floor elevation is around the current elevation, it appears that the slabs for the structures will bear on the Stratum I soils – SANDS (SM, SP) and CLAYS (CL). Provided the subgrade recommendations of this report are followed, this material is likely suitable for the support of a slab-on-grade.

Subgrade Modulus: Provided the Subgrade Preparations and Earthwork Operations Sections of this report are followed, the slab may be designed assuming a modulus of subgrade reaction, k of 125 pci (lbs/cu. inch). The modulus of subgrade reaction value is based on a 1 ft by 1 ft plate load test basis.

Slab Isolation: Ground-supported slabs should be isolated from the foundations and foundation-supported elements of the structure 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 prevents the use of a free-floating slab, the slab should be designed with suitable reinforcement and load transfer devices to preclude overstressing of the slab. Maximum differential settlement of soils supporting interior slabs is anticipated to be less than 0.5 inches in 50 feet.

4.1.3 Seismic Design Considerations

Seismic Site Classification: The International Building Code (IBC) 2009 requires site classification for seismic design based on the upper 100 feet of a soil profile. Three methods are utilized in classifying sites, namely the shear wave velocity (v_s) method; the unconfined compressive strength (s_u) method; and the Standard Penetration Resistance (N-value) method. The first method (shear wave velocity) was used in classifying this site.

The results of the shear wave velocity profiles are contained in Appendix C. The seismic site class definitions for the weighted average of shear wave velocity or SPT N-value in the upper 100 feet of the soil profile are shown in the following table:

Table 4.1.3.1: Seismic Site Classification

Site Class	Soil Profile Name	Shear Wave Velocity, Vs, (ft./s)	N value (bpf)
A	Hard Rock	Vs > 5,000 fps	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A
C	Very dense soil and soft rock	1,200 < Vs ≤ 2,500 fps	>50
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 60
E	Soft Soil Profile	Vs < 600 fps	<15

The North Carolina Building Code (2009 International Building Code with North Carolina Amendments) requires that a seismic Site Class be assigned for new structures. The seismic Site Class for the site was determined by calculating a weighted average of the shear velocities of the overburden to the depth of rock/refusal. The CPT test data indicates that the existing natural, overburden soils at the site have shear velocities ranging from approximately 240 ft/sec to 1,260 ft/sec. The method for determining the weighted average value is presented in Section 1613.5.5 of the IBC 2009. The weighted average value for the site is 844 ft/sec. Based on the results of the CPT soundings, the site is assigned a seismic site class “D”. However, liquefiable soils are present at the site that will cause liquefaction induced settlements and the IBC classifies sites with the potential for liquefaction as Seismic Site Class “F”.

The IBC 2009 allows the design spectral response accelerations for a site to be determined without regard to liquefaction provided buildings have a fundamental period of less than or equal to 0.5 seconds and the risks of liquefaction are considered in design. The buildings should meet this criterion; however, this must be confirmed by the Structural Engineer.

The Site Class definition should not be confused with the Seismic Design Category designation, which the Structural Engineer typically assesses. If a higher site classification is beneficial to the project, ECS would be pleased to discuss additional testing capabilities in this regard.

If a Site Class F must be used, a site specific seismic hazard analysis (which is beyond our scope of work) is needed to determine the seismic design parameters. As such, additional seismic hazard analysis of the site could be needed to satisfy code requirements.

Liquefaction: When a saturated soil with little to 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 0.14, an earthquake event with a magnitude of 7.3 and procedures developed by Robertson (2009) and Boulanger & Idriss (2014), the liquefaction induced settlement at the subject site is estimated to generally range from approximately 1 to 3 inches. This settlement would result from volumetric compression of the liquefiable sand layers which occurs as seismically-induced excess soil pore water pressures dissipate.

If risks associated with liquefaction are not acceptable or the proposed structure cannot be designed to accommodate the anticipated settlement without suffering catastrophic failure, ground improvement techniques will be required. Ground improvement techniques such as vibro-replacement and geo-composite drains could be designed to mitigate or reduce the site's susceptibility to liquefaction and allow support of the structure on conventional shallow foundations.

4.2.1 Pavement Sections

Subgrade Characteristics: Based on the results of our hand auger borings, it appears that the soils that will be exposed as pavement subgrades generally consist of SANDS (SM, SP) and CLAYS (CL). Based on the Kessler DCP results, a CBR value of 8 has been selected to model the in place subgrade soils. The pavement design assumes subgrades consist of suitable materials evaluated by ECS and placed and compacted to at least 98 percent of the maximum dry density as determined by the standard Proctor test (ASTM D 698) in accordance with the project specifications. Due to loose and soft soils in the upper 2 feet of the subgrade soils, isolated in place densification and undercutting up to approximately 2 feet should be anticipated in areas of the proposed parking and drive areas.

Design Considerations: For the design and construction of exterior pavements, the subgrades should be prepared in strict accordance with the recommendations in the "Subgrade Preparation" and "Engineered Fill Placement" sections of this report. An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Furthermore, good drainage should minimize the possibility of the subgrade materials becoming saturated during the normal service period of the pavement.

Anticipated traffic conditions were not provided to ECS. However, based on our experience for light duty traffic for similar projects, a flexible pavement section may consist of at least 2 inches of surface mix asphalt overlying at least 6 inches of grade aggregate base in the parking areas. Similarly, a heavy duty, flexible pavement section may consist of at least 3 inches of surface mix asphalt overlying at least 8 inches of graded aggregate base in the roadway areas. For a rigid pavement section, we recommend 6 inches of 650 psi flexible strength concrete underlain by 4 inches of ABC stone.

The graded aggregate based course materials beneath pavements should be compacted to at least 98 percent of their modified Proctor maximum dry density (ASTM D 1557).

Regardless of the section and type of construction utilized, saturation of the subgrade materials and asphalt pavement areas results in a softening of the subgrade material and shortened life span for the pavement. Therefore, we recommend that both the surface and subsurface materials for the pavement be properly graded to enhance surface and subgrade drainage. By quickly removing surface and subsurface water, softening of the subgrade can be reduced and the performance of the parking area can be improved. Site preparation for the parking areas should be similar to that for the building area including stripping, proofrolling, and the placement of compacted structural fill.

5.0 SITE CONSTRUCTION RECOMMENDATIONS

5.1 SUBGRADE PREPARATION

5.1.1 Stripping and Grubbing

It should be noted that the natural geology of the site has been modified in the past; therefore potential unsuitable material may be present on the site. The subgrade preparation should consist of stripping all vegetation, rootmat, topsoil, existing fill, and any other soft or unsuitable materials from the 10-foot expanded building area and 5-foot expanded pavement areas. ECS should be called on to verify that topsoil and unsuitable surficial materials have been completely removed prior to the placement of structural fill or construction of the building and parking lot.

5.1.2 Proofrolling

After removing all unsuitable surface materials, cutting to the proposed grade, and prior to the placement of any structural fill or other construction materials, the exposed subgrade should be examined by the geotechnical engineer or authorized representative. The exposed subgrade should be thoroughly proofrolled with previously approved construction equipment having a minimum axle load of 10 tons (e.g. fully loaded tandem-axle dump truck). The areas subject to proofrolling should be traversed by the equipment in two perpendicular (orthogonal) directions with overlapping passes of the vehicle under the observation of the geotechnical engineer or authorized representative. This procedure is intended to assist in identifying any localized yielding materials. In the event that unstable or "pumping" subgrade is identified by the proofrolling, those areas should be marked for repair prior to the placement of any subsequent structural fill or other construction materials. Methods of repair of unstable subgrade, such as undercutting or moisture conditioning or chemical stabilization, should be discussed with the geotechnical engineer to determine the appropriate procedure with regard to the existing conditions causing the instability. Test pits may be excavated to explore the shallow subsurface materials in the area of the instability to help in determined the cause of the observed unstable materials and to assist in the evaluation of the appropriate remedial action to stabilize the subgrade.

5.1.3 Site Temporary Dewatering

Subsurface Water: Due to the relatively shallow groundwater conditions observed at select locations during this exploration, temporary construction dewatering may be necessary to facilitate efficient below-grade construction. Dewatering operations for the majority of the site can be handled by the use of conventional submersible pumps directly in the excavation or temporary trenches or French drains consisting of free draining granular stone wrapped in filter fabric 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 electric pumps or manned gasoline pumps be used during construction.

5.2 EARTHWORK OPERATIONS

5.2.1 Structural Fill Materials

Product Submittals: Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and off-site borrow should be submitted to ECS for laboratory testing, which will include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications.

Satisfactory Structural Fill Materials: Materials satisfactory for use as structural fill should consist of inorganic soils classified as SM, SC, SW, SP, GW, GP, GM, and GC, or a combination of these group symbols, per ASTM D 2487. Natural fine-grained soils classified as clays or silts (CL, ML) should generally not be considered for use as engineered fill, but may be evaluated by the geotechnical engineer to determine their suitability at the contractor's request. The materials should be free of organic matter, debris, and should contain no particle sizes greater than 4 inches in the largest dimension. Open graded materials, such as gravels (GW and GP), which contain void space in their mass should not be used in structural fills unless properly encapsulated with filter fabric. Suitable structural fill material should have the index properties shown in Table 5.2.1.1.

Table 5.2.1.1 Structural Fill Index Properties

Location with Respect to Final Grade	LL	PI	Max % Fines Passing # 200 Sieve
Building Area	35 max	9 max	20
Pavement Area	35 max	9 max	20

Unsatisfactory Materials: Materials that should not be used as engineered fill include topsoil, organic materials (OH, OL), and high plasticity clays and silts (CH, MH). Such materials removed during grading operations should be either stockpiled for later use in landscape fills, or placed in approved on or off-site disposal areas.

On-Site Borrow Suitability: Near surface SANDS (SM, SP) with a fines content less than 20 percent should be suitable for re-use as structural fill. A majority of the soils present in the location of the proposed stormwater pond, corresponding to borings DP-1 through DP-3, are not consider suitable for re-use as structural fill. Moisture conditioning should be anticipated for the soils to achieve the optimum moisture content for fill placement.

5.2.2 Compaction

Structural Fill Compaction: Structural fill within the expanded building, pavement, and embankment limits should be placed in maximum 8-inch loose lifts, moisture conditioned as necessary to within -3 and +3 % of the soil's optimum moisture content, and be compacted with suitable equipment to a dry density of at least 98% of the standard Proctor maximum dry density (ASTM D698). Beyond these areas, compaction of at least 95% should be achieved. ECS should be called on to document that proper fill compaction has been achieved.

Fill Compaction Control: The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for the proposed construction area, at the time of fill placement. Grade controls should be maintained throughout the filling operations. All filling operations should be observed on a full-time basis by a qualified representative of the construction testing laboratory to determine that the minimum compaction requirements are being achieved. Field density testing of fills will be performed at the frequencies shown in Table 5.2.2.1, but not less than 1 test per lift.

Table 5.2.2.1 Frequency of Compaction Tests in Fill Areas

Location	Frequency of Tests
Building Area	1 test per 2,500 sq. ft.
Utility Trenches	1 test per 200 sq. ft.
Pavement Areas	1 test per 10,000 sq. ft.

Compaction Equipment: Compaction equipment suitable to the soil type being compacted should be used to compact the subgrades and fill materials. Sheepsfoot compaction equipment should be suitable for the fine-grained soils (Clays and Silts). A vibratory steel drum roller should be used for compaction of coarse-grained soils (Sands) as well as for sealing compacted surfaces.

Fill Placement Considerations: 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 all 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.

At the end of each work day, all fill areas should be graded to facilitate drainage of any precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils.

Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage should be maintained during the earthwork phases of construction to prevent ponding of water which has a tendency to degrade subgrade soils.

Where fill materials will be placed to widen existing embankment fills, or placed up against sloping ground, the soil subgrade should be scarified and the new fill benched or keyed into the existing material. Fill material should be placed in horizontal lifts. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 inches to 4 inches may be required to achieve specified degrees of compaction.

We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of higher plasticity soils is difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

5.3 GENERAL CONSTRUCTION CONSIDERATIONS

Moisture Conditioning: During the cooler and wetter periods of the year, delays and additional costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives, such as lime or cement, in order to lower moisture contents to levels appropriate for compaction. Alternatively, during the drier times of the year, such as the summer months, moisture may need to be added to the soil to provide adequate moisture for successful compaction according to the project requirements.

Subgrade Protection: Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas. It would be advisable to designate a haul road and construction staging area to limit the areas of disturbance and to prevent construction traffic from excessively degrading sensitive subgrade soils and existing pavement areas. Haul roads and construction staging areas could be covered with excess depths of aggregate to protect those subgrades. The aggregate can later be removed and used in pavement areas.

Surface Drainage: Surface drainage conditions should be properly maintained. Surface water should be directed away from the construction area, and the work area should be sloped away from the construction area at a gradient of 1 percent or greater to reduce the potential of ponding water and the subsequent saturation of the surface soils. At the end of each work day, the subgrade soils should be sealed by rolling the surface with a smooth drum roller to minimize infiltration of surface water.

Excavation Safety: Cuts or excavations associated with utility excavations may require forming or bracing, slope flattening, or other physical measures to control sloughing and/or prevent slope failures. Contractors should be familiar with applicable OSHA codes to ensure that adequate protection of the excavations and trench walls is provided.

Excavation Considerations: Based on the results of the soundings, we expect that the natural Coastal Plain soils encountered on this site can be excavated with conventional earth moving equipment such as loaders, bulldozers, rubber tired backhoes, etc.

The site soils are OSHA Type C soils for the purpose of temporary excavation support. Excavations should be constructed in compliance with current OSHA standards for excavation and trenching safety. Excavations should be observed by a “competent person,” as defined by OSHA, who should evaluate the specific soil type and other conditions, which may control the excavation side slopes or the need for shoring or bracing. Regardless, site safety shall be the sole responsibility of the contractor and their subcontractors. Exposed earth slopes shall be protected during periods of inclement weather.

Erosion Control: The surface soils may be erodible. Therefore, the contractor should provide and maintain good site drainage during earthwork operations to maintain the integrity of the surface soils. All erosion and sedimentation controls should be in accordance with sound engineering practices and local requirements.

6.0 CLOSING

ECS has prepared this report of findings, evaluations, and recommendations to guide geotechnical-related design and construction aspects of the project.

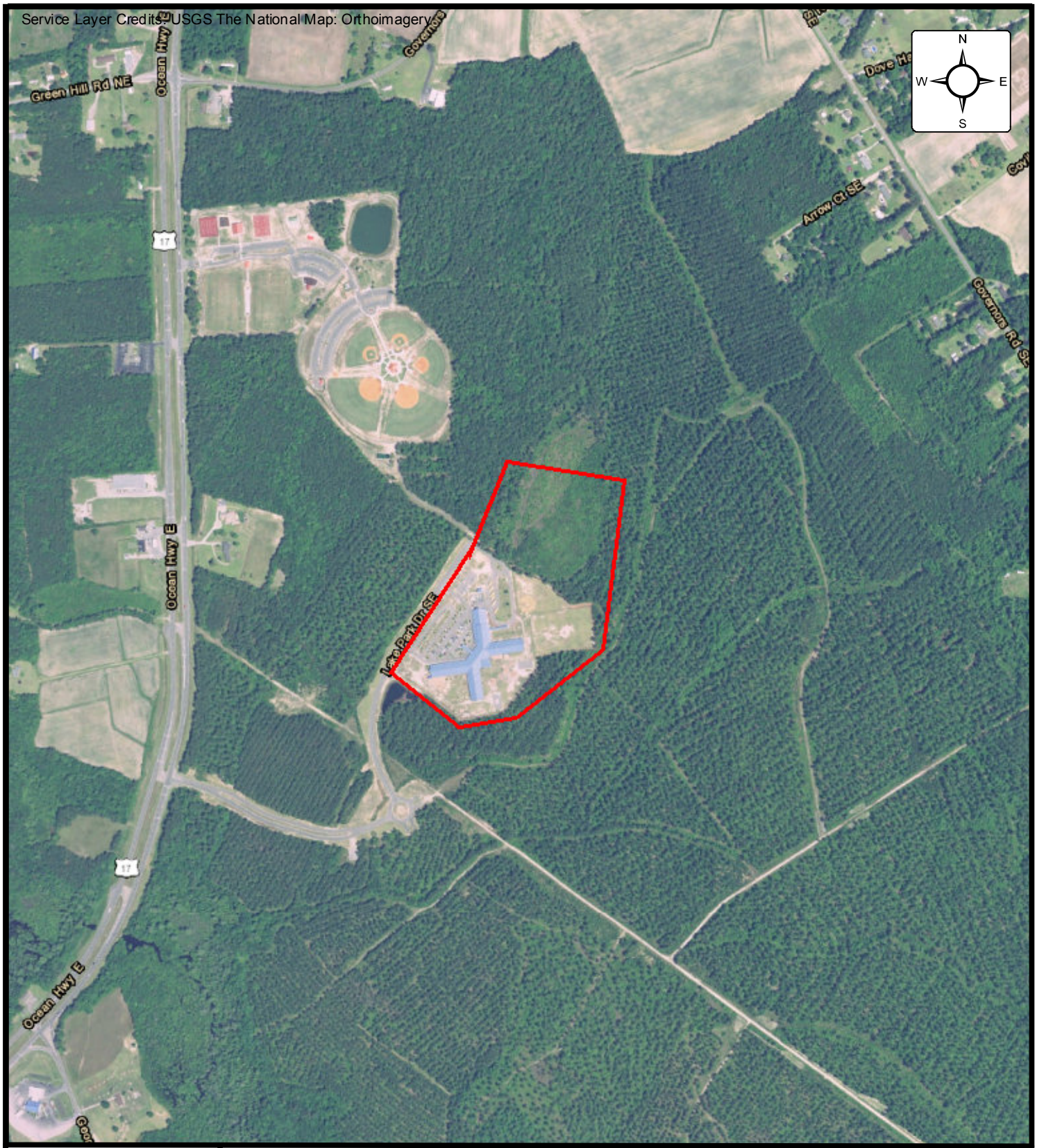
The description of the proposed project is based on information provided to ECS by Brunswick County Schools. If any of this information is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately so that we can review the report in light of the changes and provide additional or alternate recommendations as may be required to reflect the proposed construction.

We recommend that ECS be allowed to review the project's plans and specifications pertaining to our work so that we may ascertain consistency of those plans/specifications with the intent of the geotechnical report.

Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of and integral to the geotechnical design recommendation. We recommend that the owner retain these quality assurance services and that ECS be allowed to continue our involvement throughout these critical phases of construction to provide general consultation as issues arise. ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A – Drawings & Reports

Site Location Diagram
Exploration Location Diagram



SITE LOCATION DIAGRAM

TOWN CREEK ELEMENTARY/MIDDLE SCHOOL

WINNABOW, NORTH CAROLINA

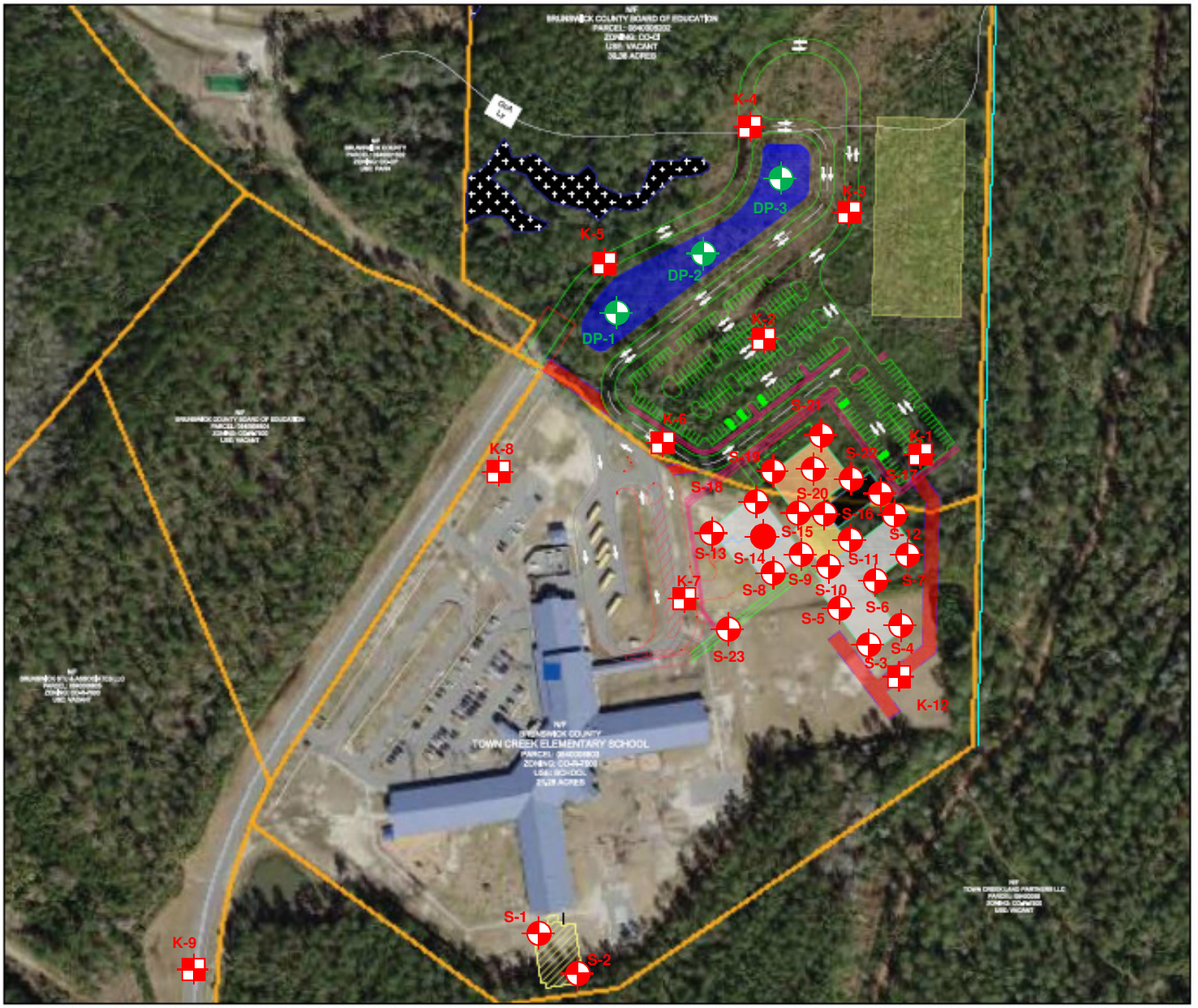
ENGINEER	WEG
SCALE	NTS
PROJECT NO.	22:25758
SHEET	1 OF 3
DATE	12/18/2017

EXPLORATION LOCATION DIAGRAM

Town Creek Elementary/Middle School

Winnabow, North Carolina

REFERENCE	McGill Associates
ENGINEER	WEG
DRAFTING	MME1
SCALE	NTS
PROJECT NO.	22-25758
SHEET	2 of 3
DATE	12/18/2017



N W E S

DENOTES APPROXIMATE LOCATION OF SOIL TEST SOUNDING WITH SHEAR WAVE VELOCITY TESTING

DENOTES APPROXIMATE LOCATION OF THE DRIECT PUSH BORING

DENOTES APPROXIMATE LOCATION OF SOIL TEST SOUNDING

DENOTES APPROXIMATE LOCATION OF HAND AUGER BORING WITH KESSLER DCP TESTS

EXPLORATION LOCATION DIAGRAM

Town Creek Elementary/Middle School

Winnabow, North Carolina



DENOTES APPROXIMATE LOCATION OF HAND AUGER BORING WITH KESSLER DCP TESTS

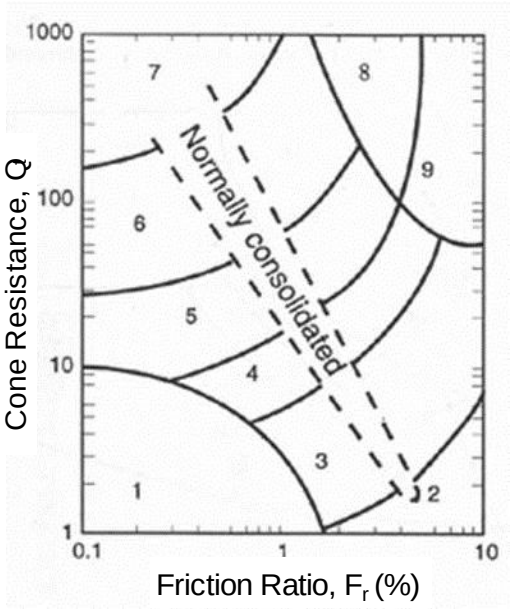
REFERENCE	Google Earth
ENGINEER	WEG
DRAFTING	MME1
SCALE	NTS
PROJECT NO.	22-25758
SHEET	3 of 3
DATE	12/18/2017

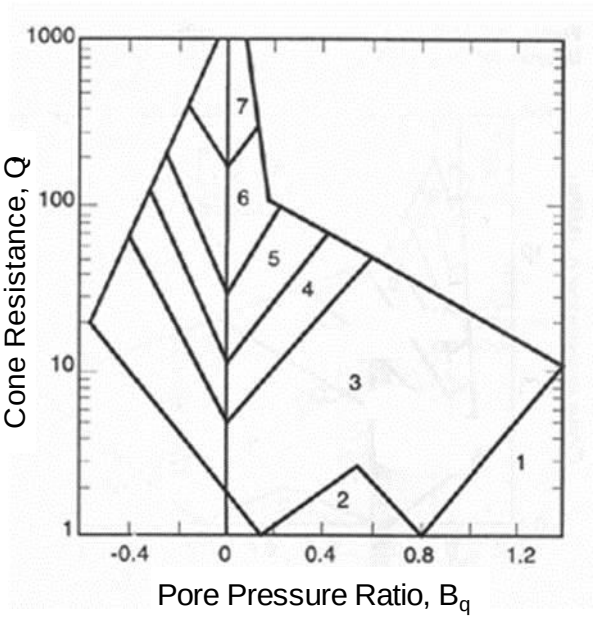
APPENDIX B – Field Operations

Reference Notes for Sounding Logs
CPT Sounding Logs -S-1 through S-23 and Shear Wave Velocity Profile
Kessler Logs
Reference Notes to USCS Classification
Hand Auger Boring Logs – K-1 through K-12
Direct Push Boring Logs – DP-1 through DP-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

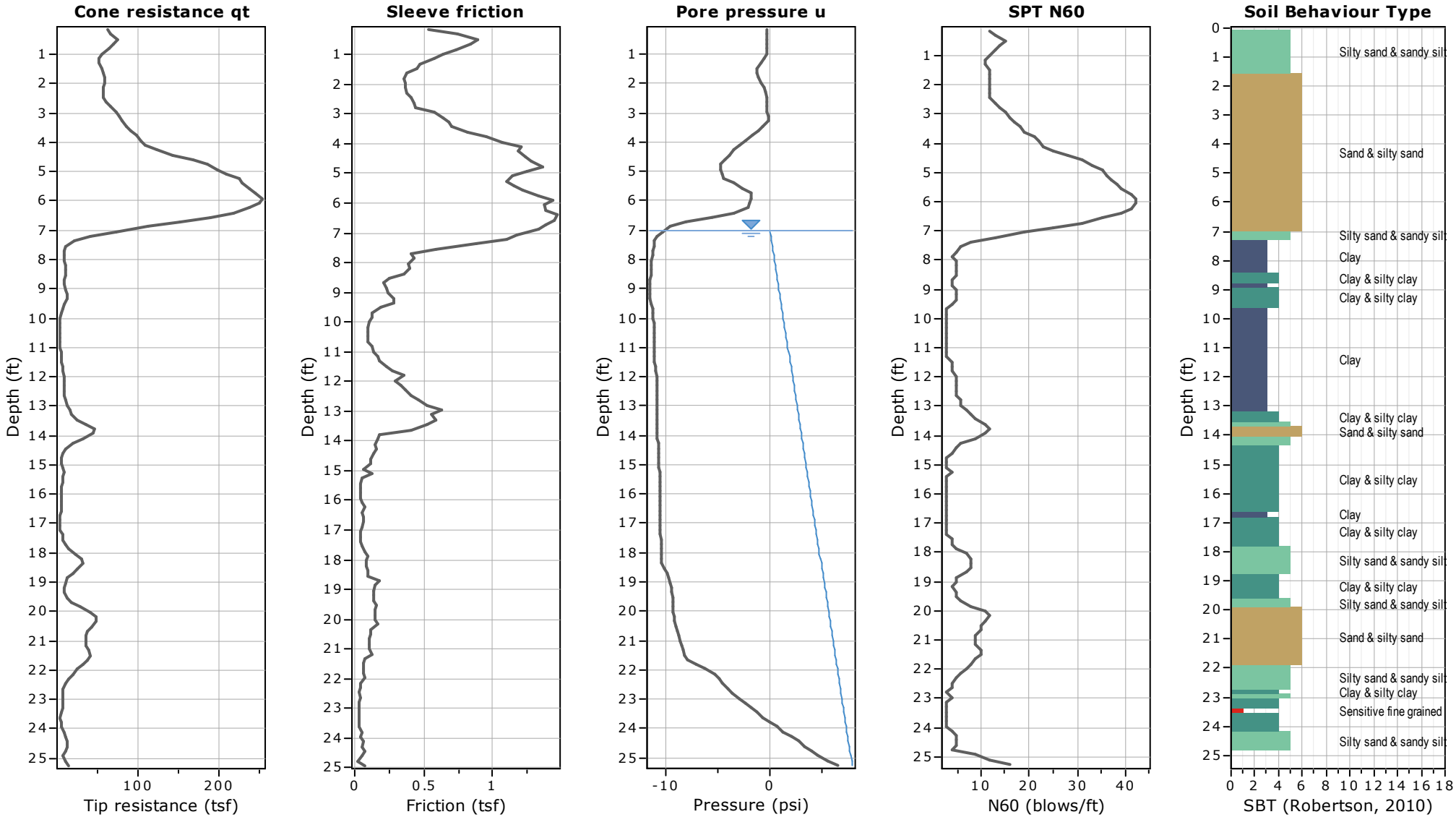
The following table presents a correlation of corrected cone tip resistance (q_c) to soil consistency or relative density:

SAND		**SILT/CLAY**	
Corrected Cone Tip Resistance (q_c) (tsf)	**Relative Density**	**Corrected Cone Tip Resistance (q_c) (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

ECS Southeast, LLP
6714 Netherlands Drive
Wilmington, NC 28405
ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

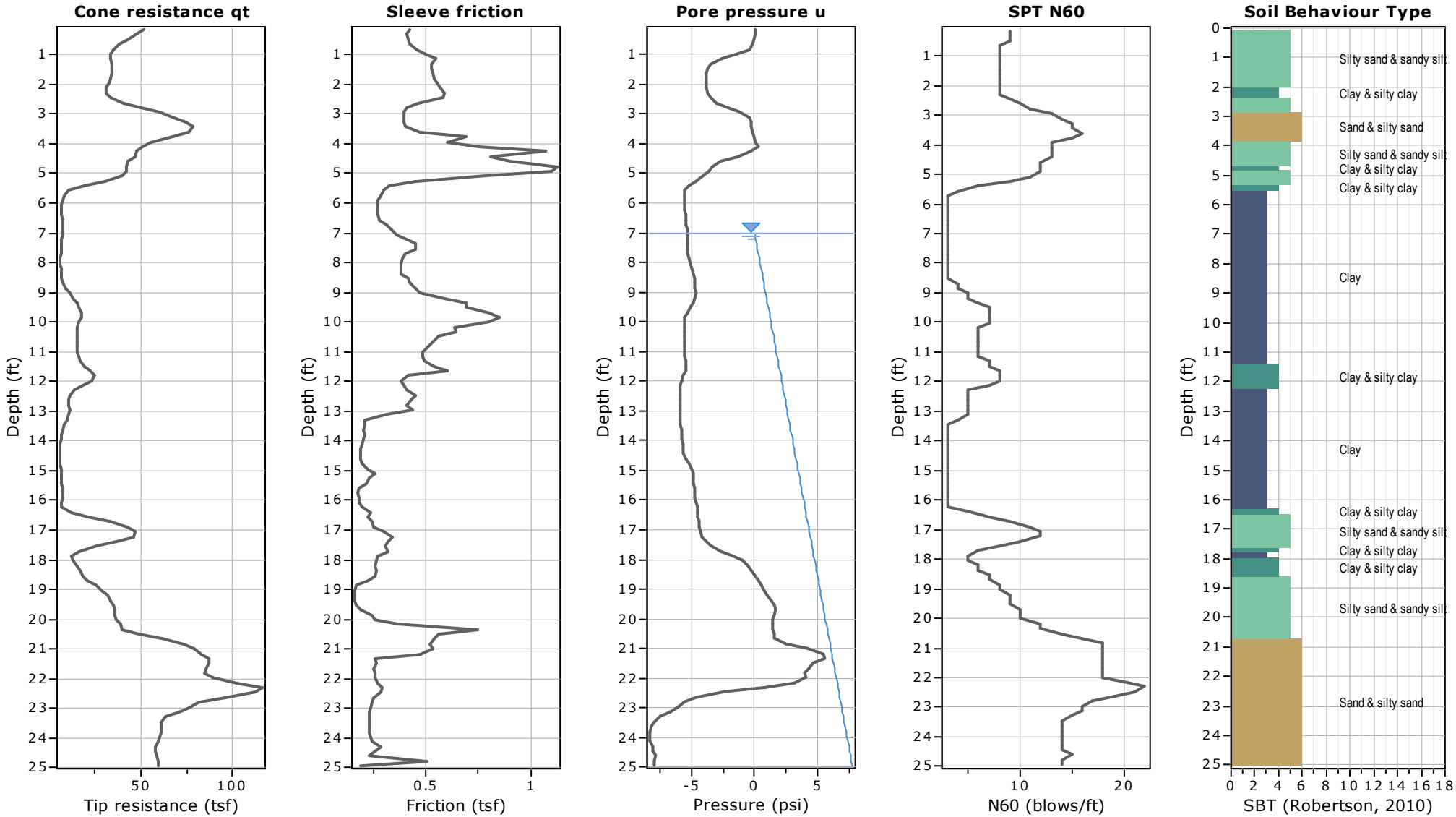
CPT: S-01
Total depth: 25.26 ft, Date: 12/4/2017



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ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

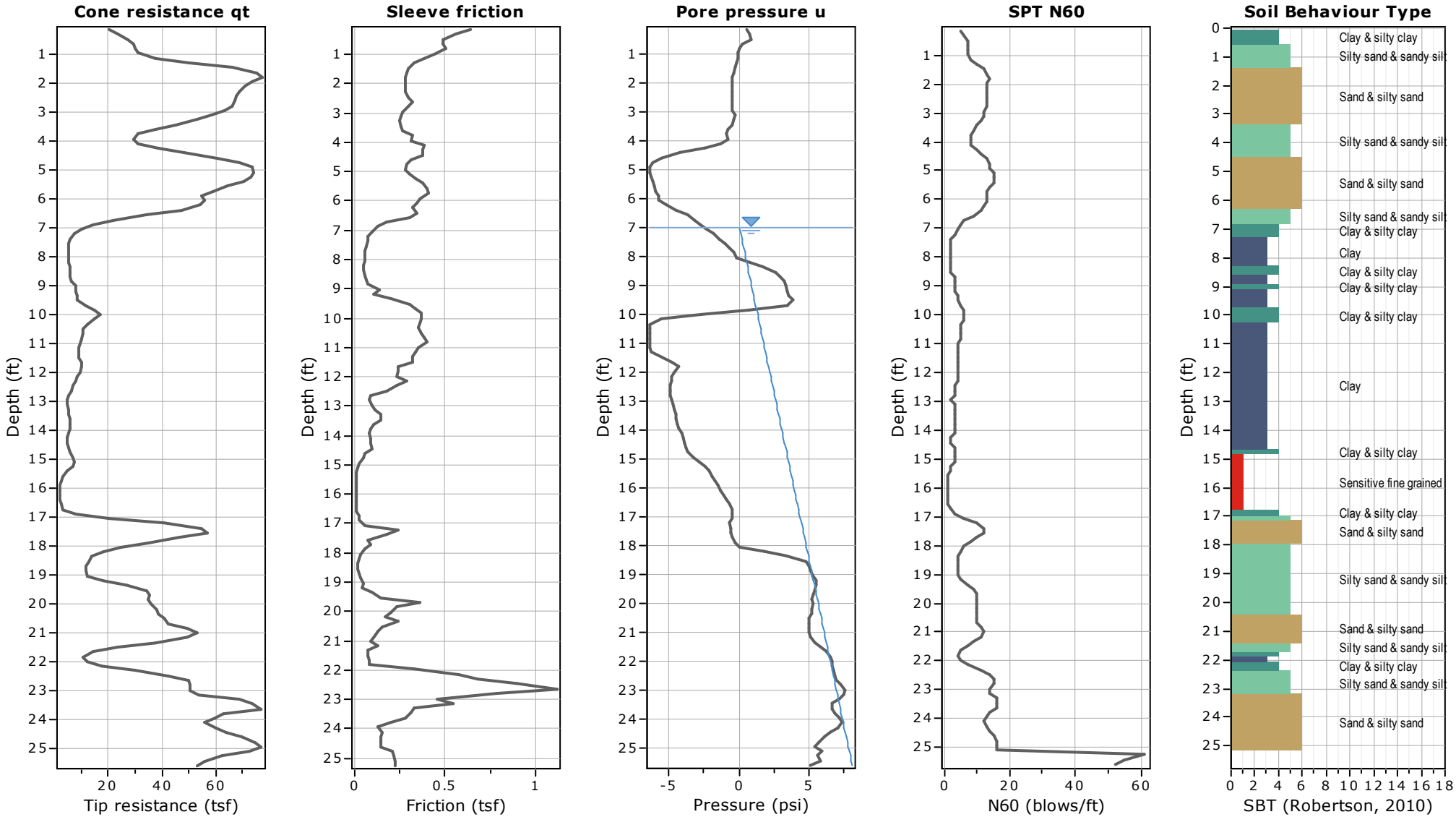
CPT: S-02
Total depth: 24.93 ft, Date: 12/4/2017



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Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

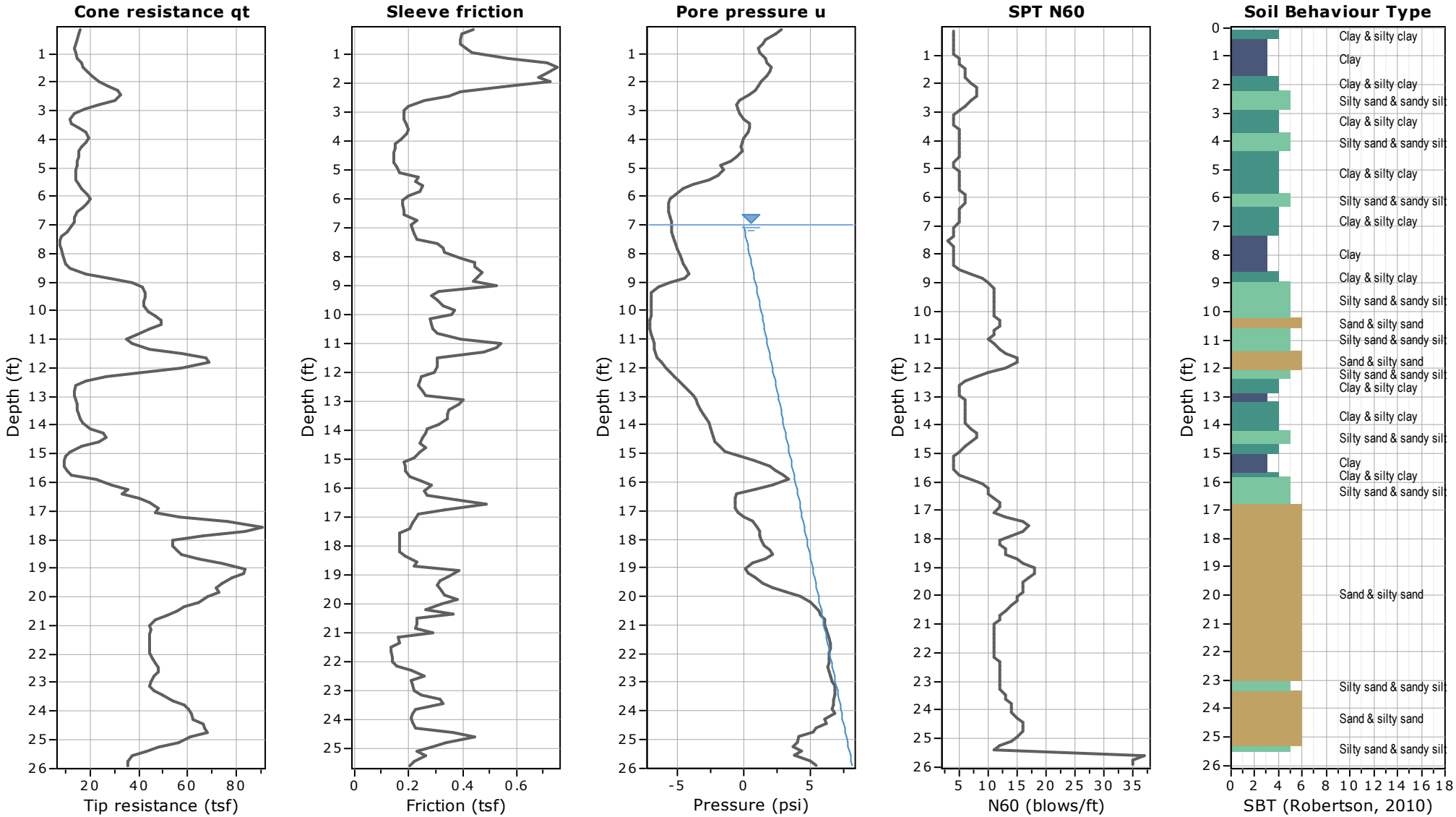
CPT: S-03
Total depth: 25.59 ft, Date: 12/4/2017



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Wilmington, NC 28405
ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

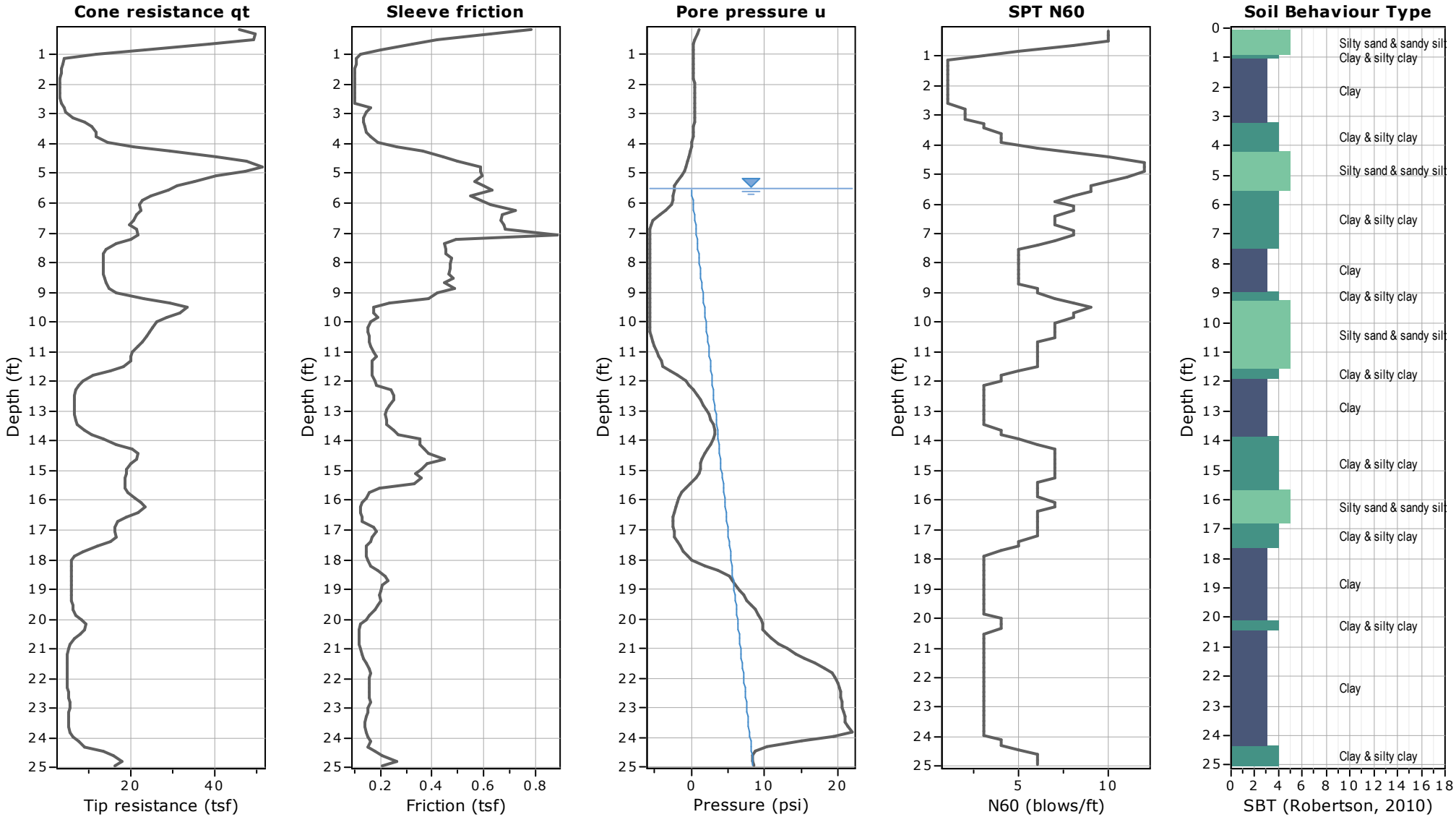
CPT: S-04
Total depth: 25.92 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

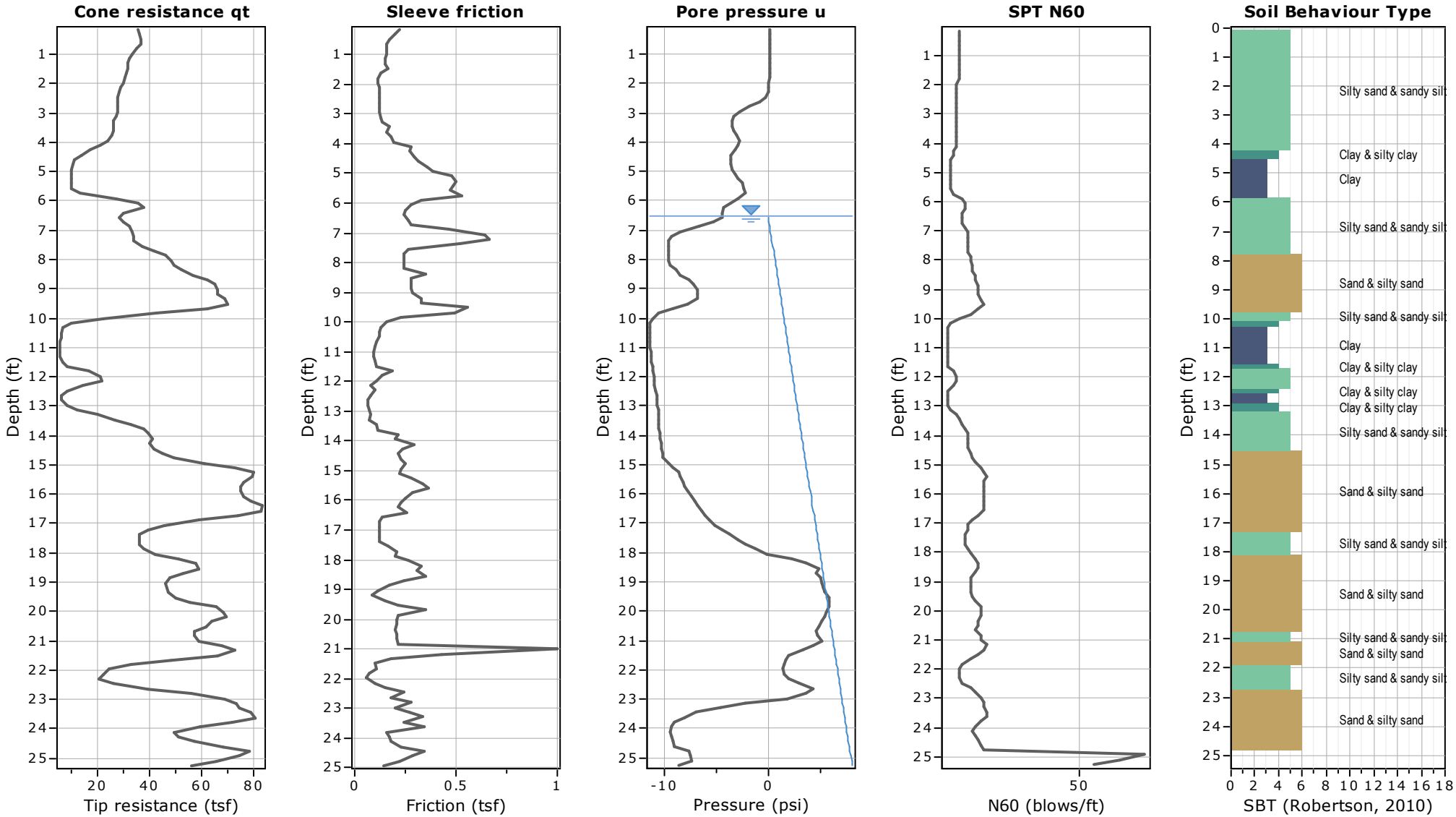
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Total depth: 24.93 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

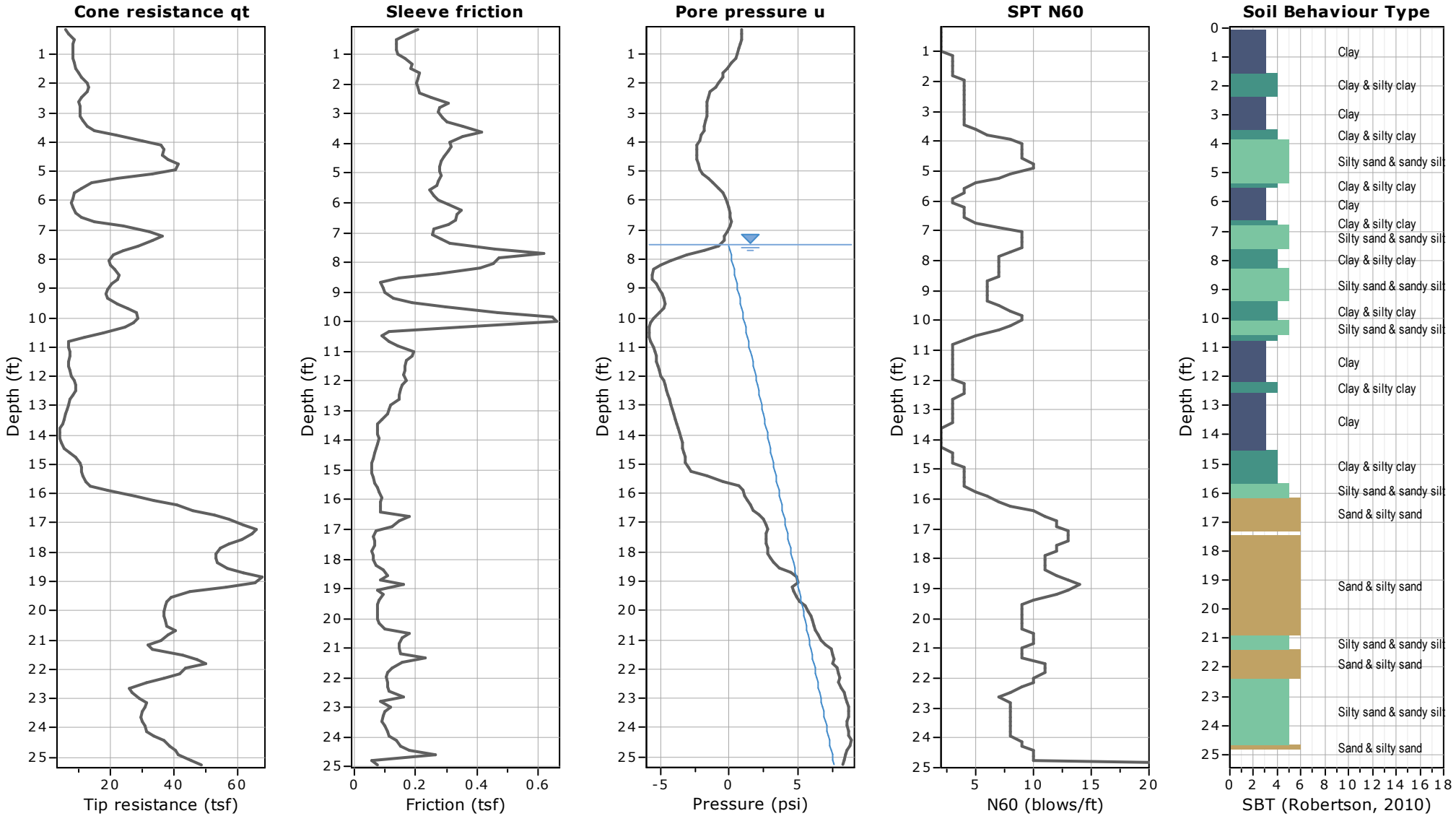
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Total depth: 25.26 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

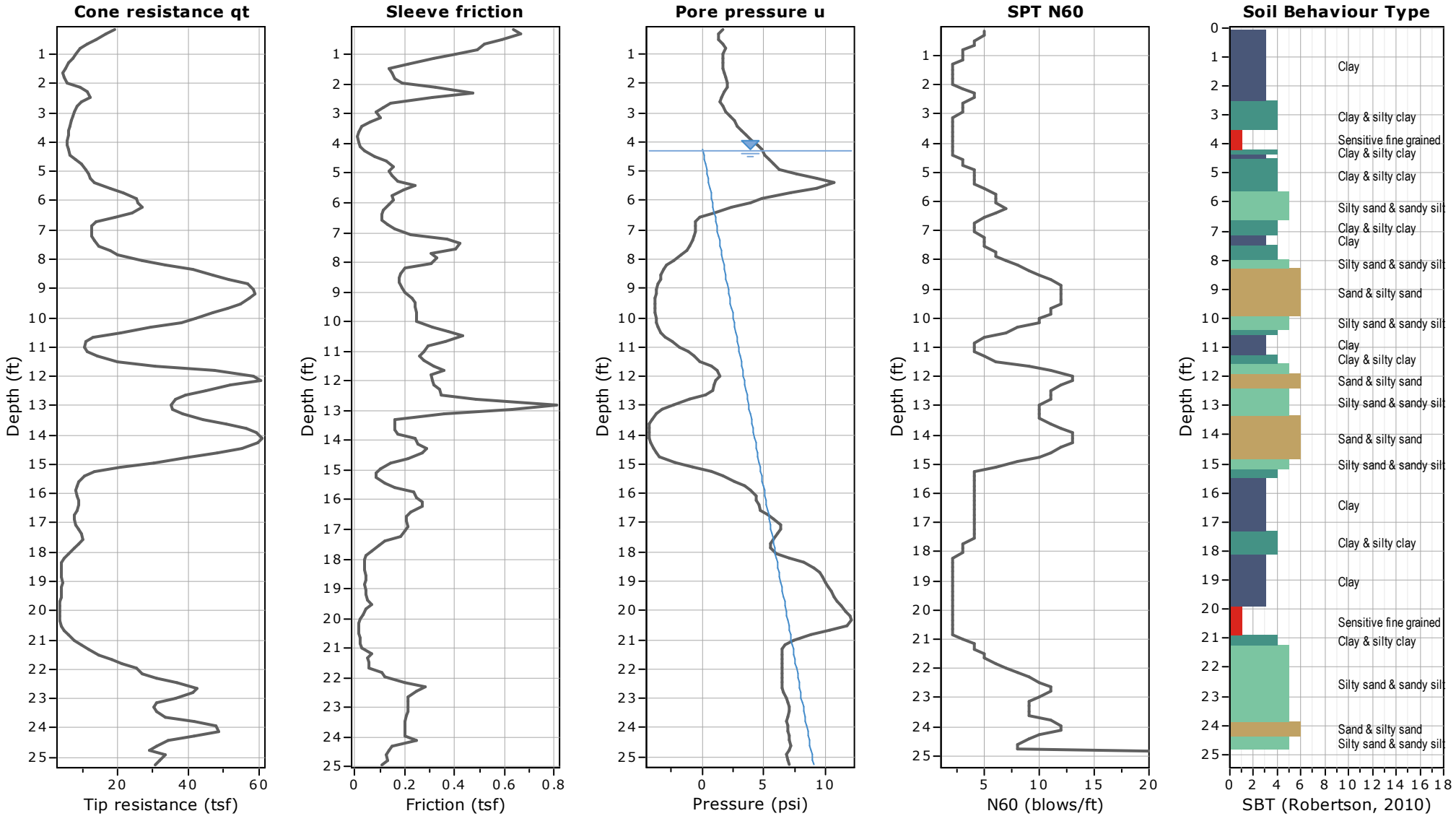
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Total depth: 25.26 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

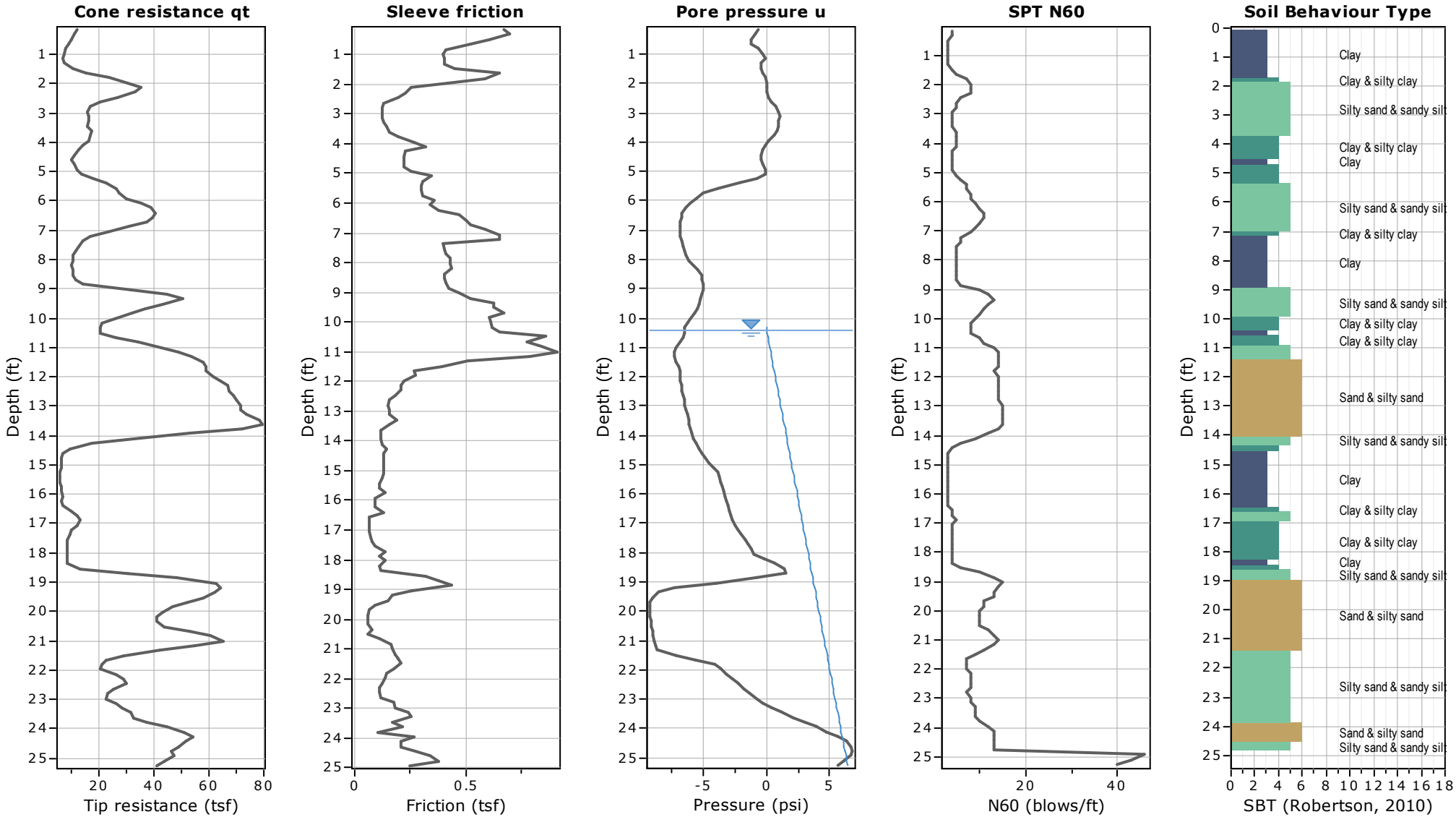
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Total depth: 25.26 ft, Date: 12/4/2017



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ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

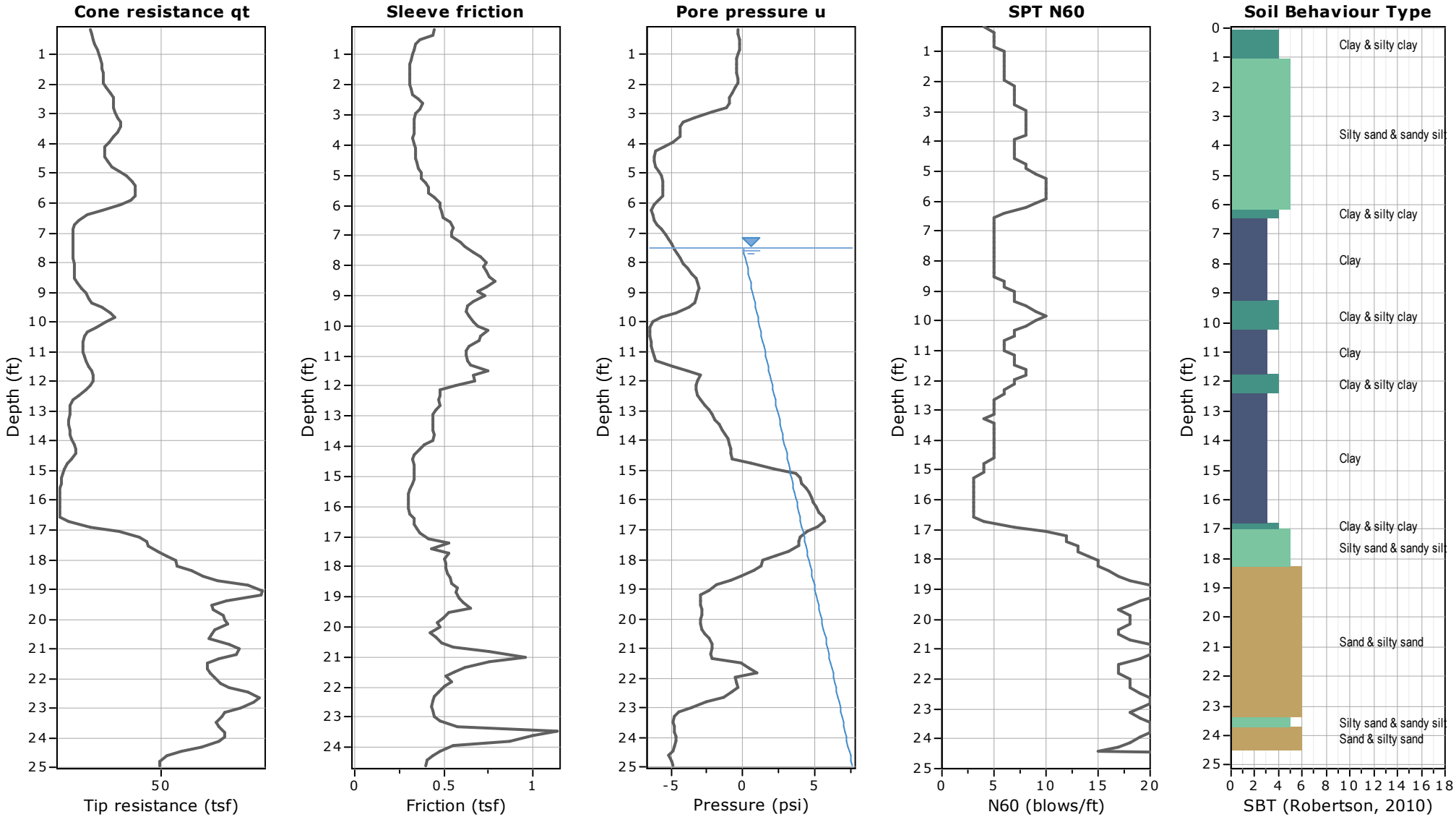
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Total depth: 25.26 ft, Date: 12/4/2017



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ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

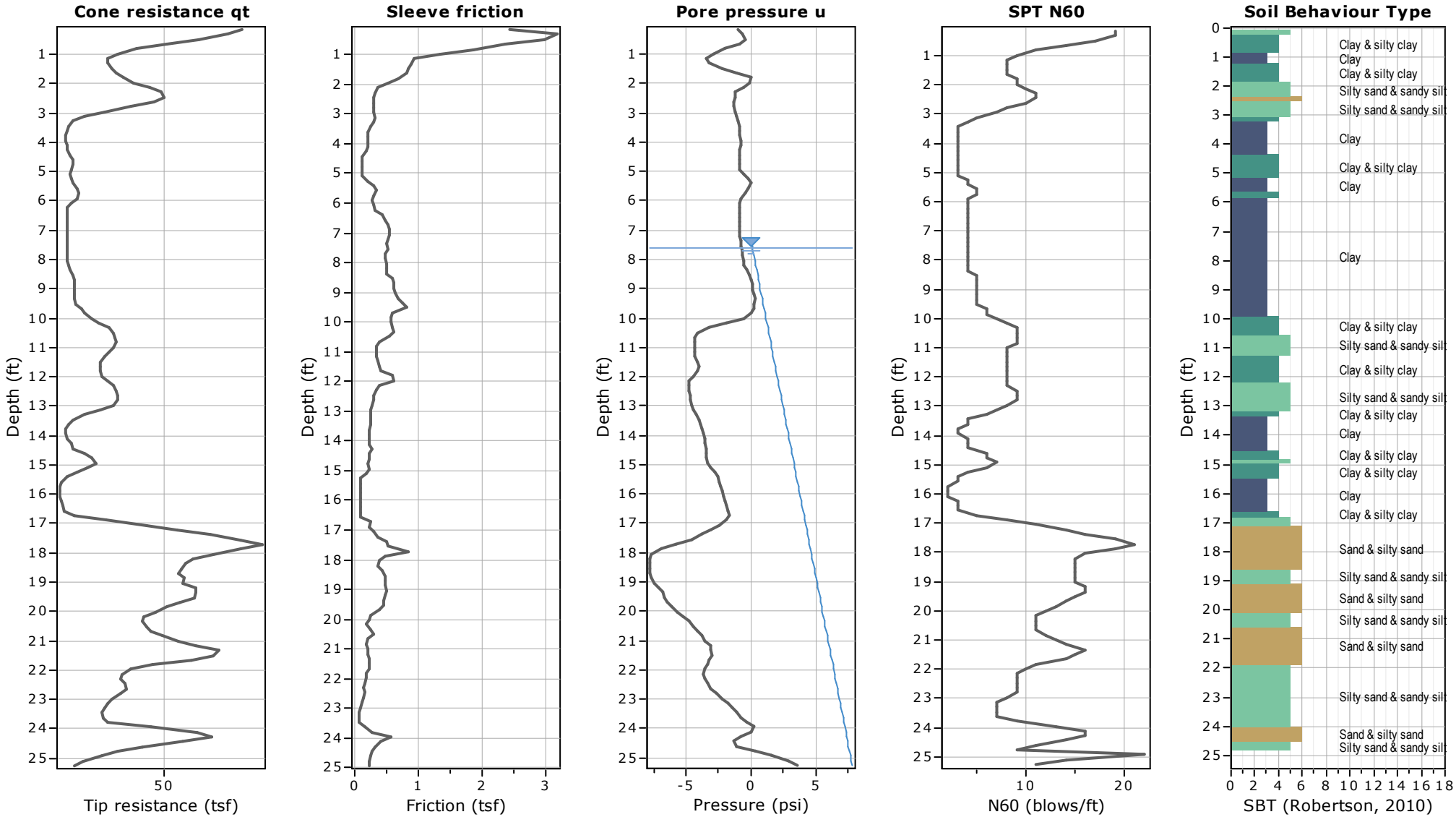
CPT: S-10
Total depth: 24.93 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

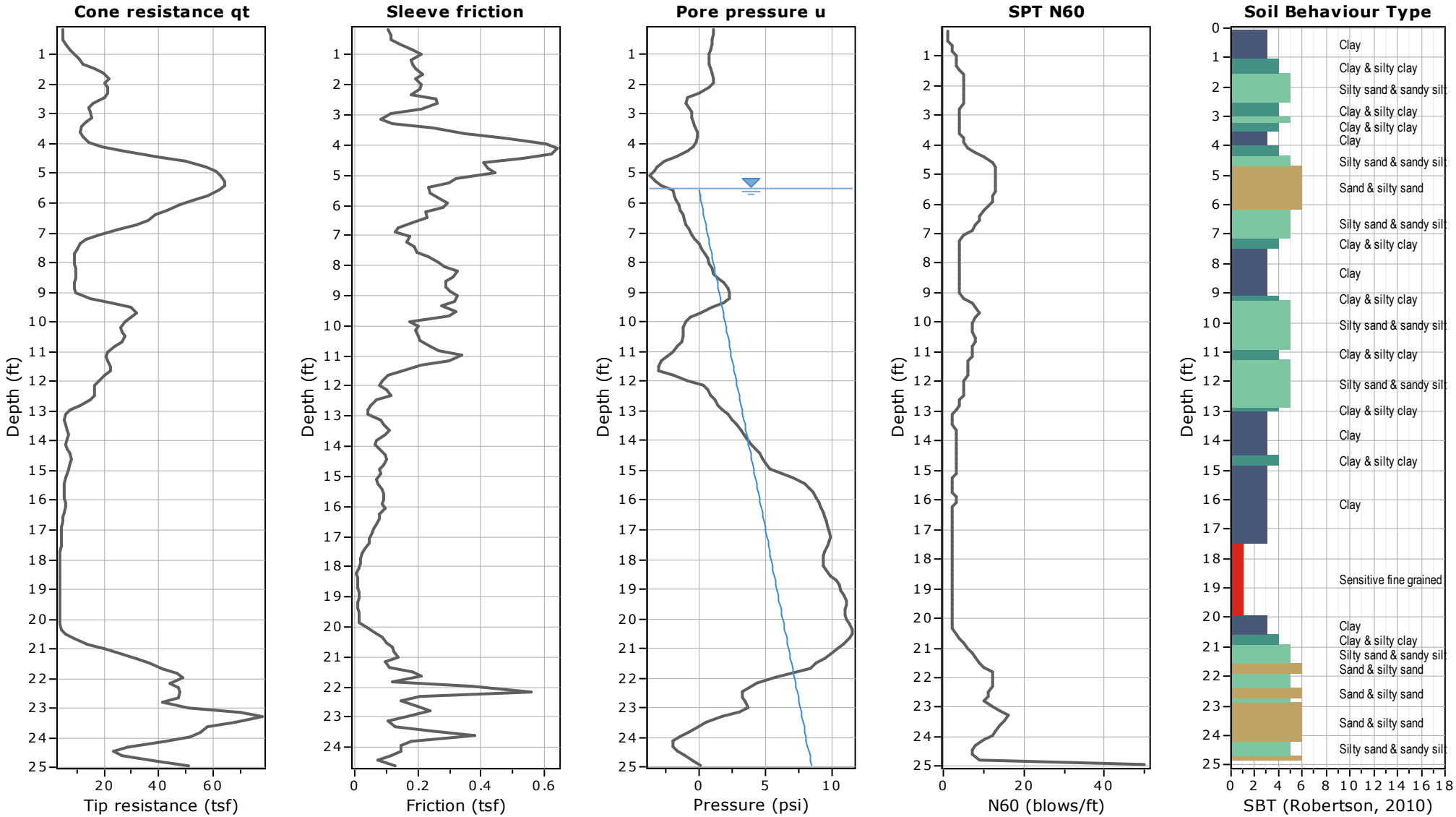
CPT: S-11
Total depth: 25.26 ft, Date: 12/4/2017



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ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

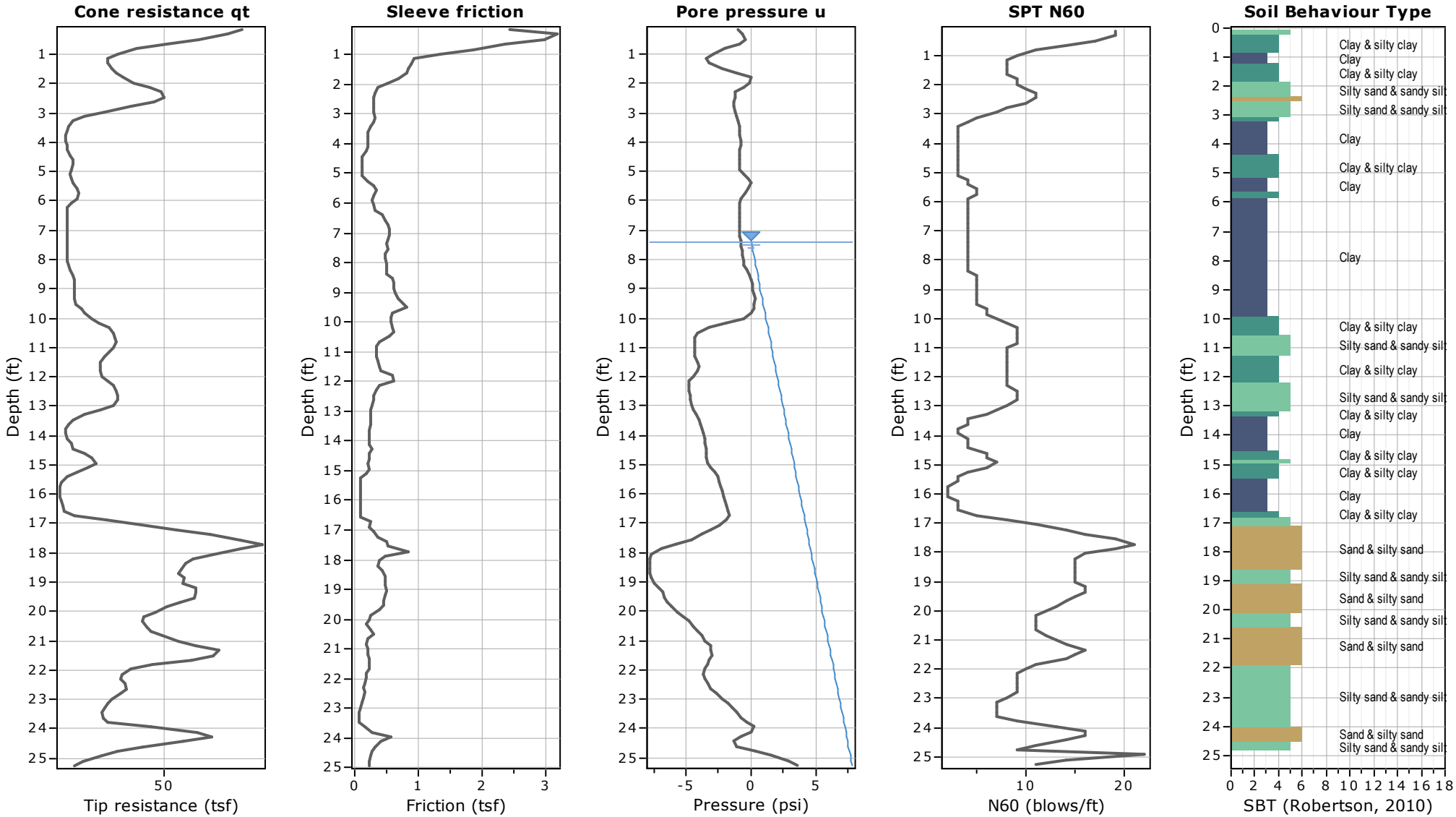
CPT: S-12
Total depth: 24.93 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

CPT: S-13
Total depth: 25.26 ft, Date: 12/4/2017



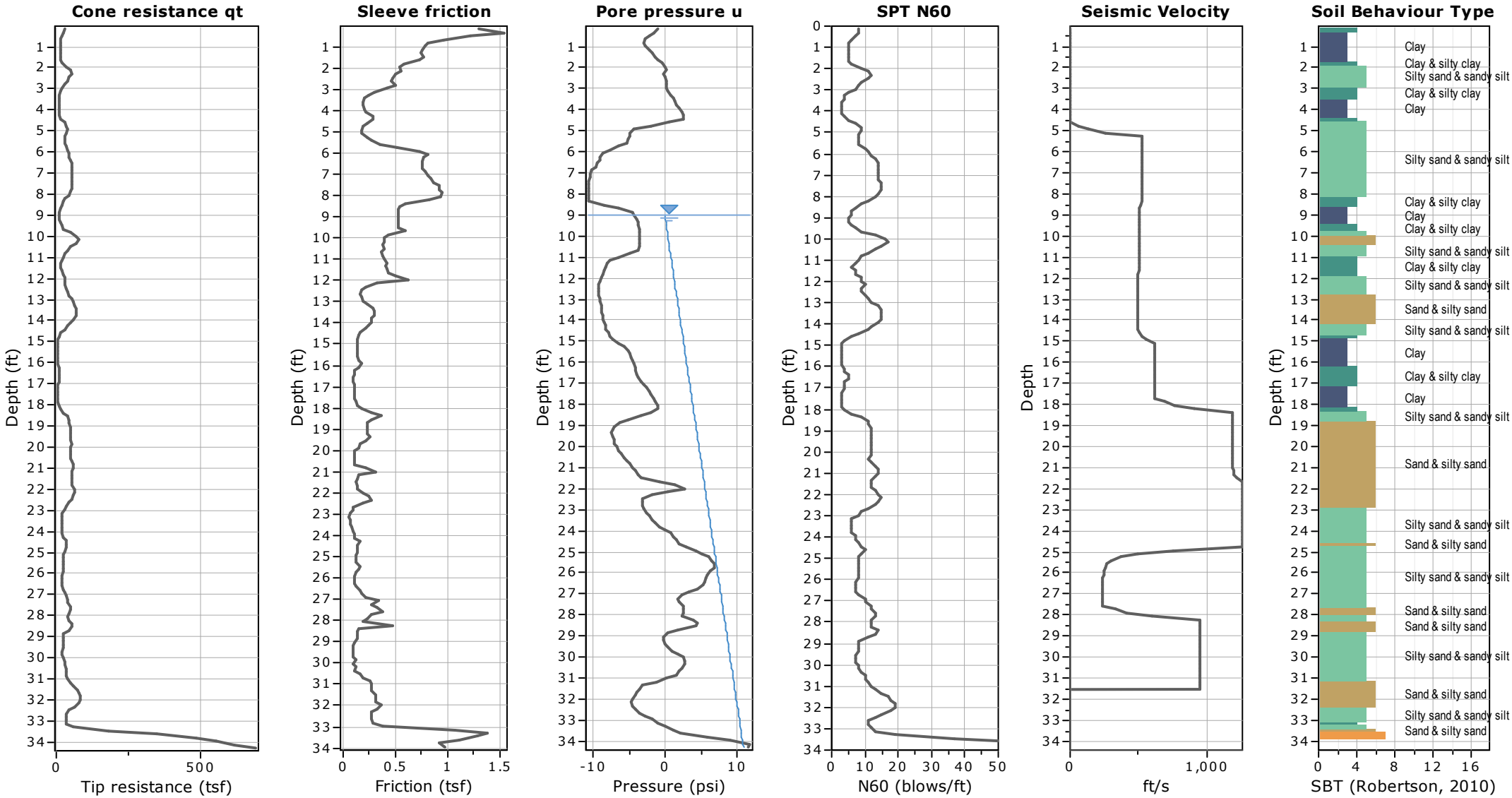
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ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**

CPT: S-14

Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

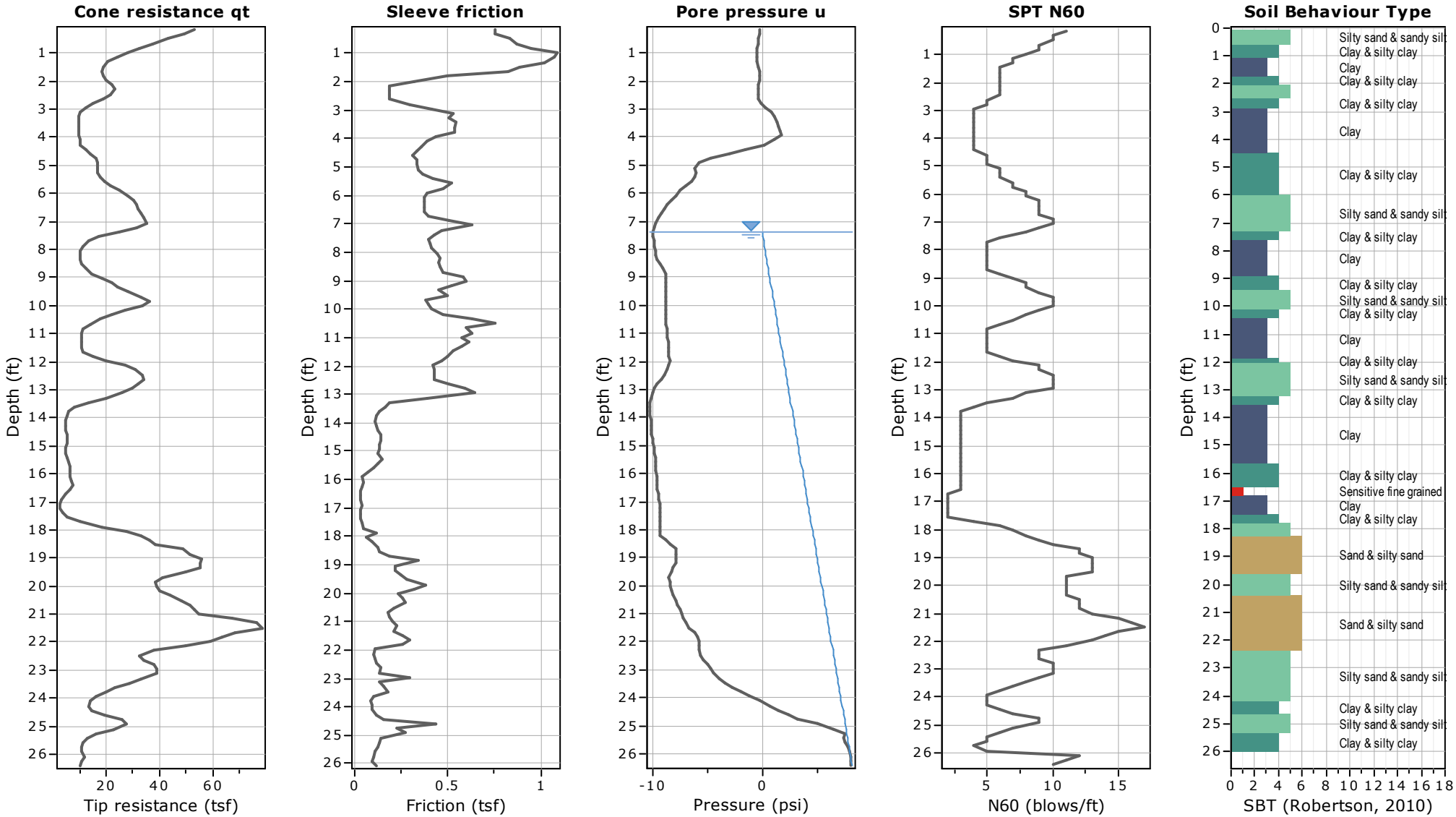
Total depth: 34.28 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

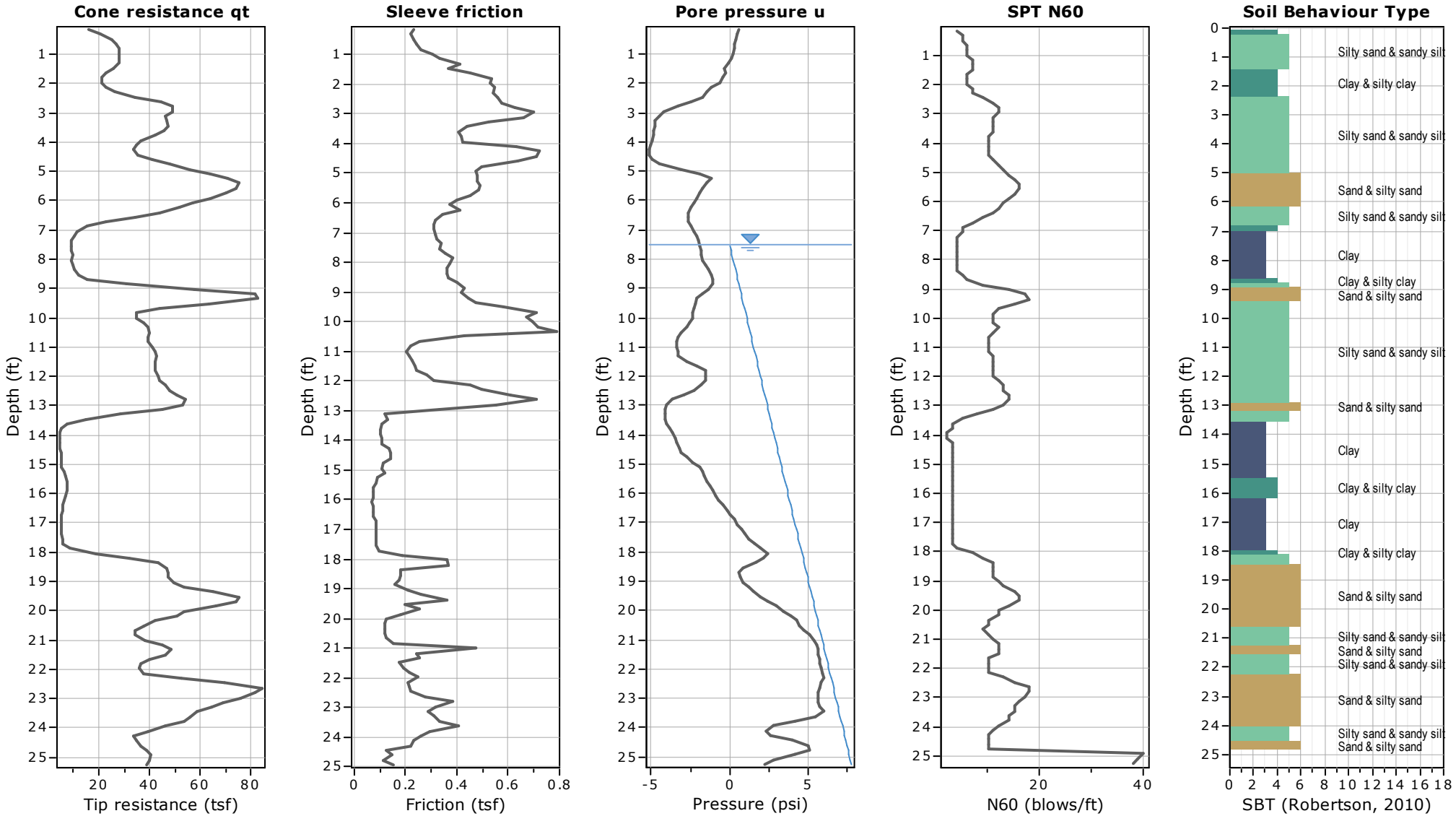
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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

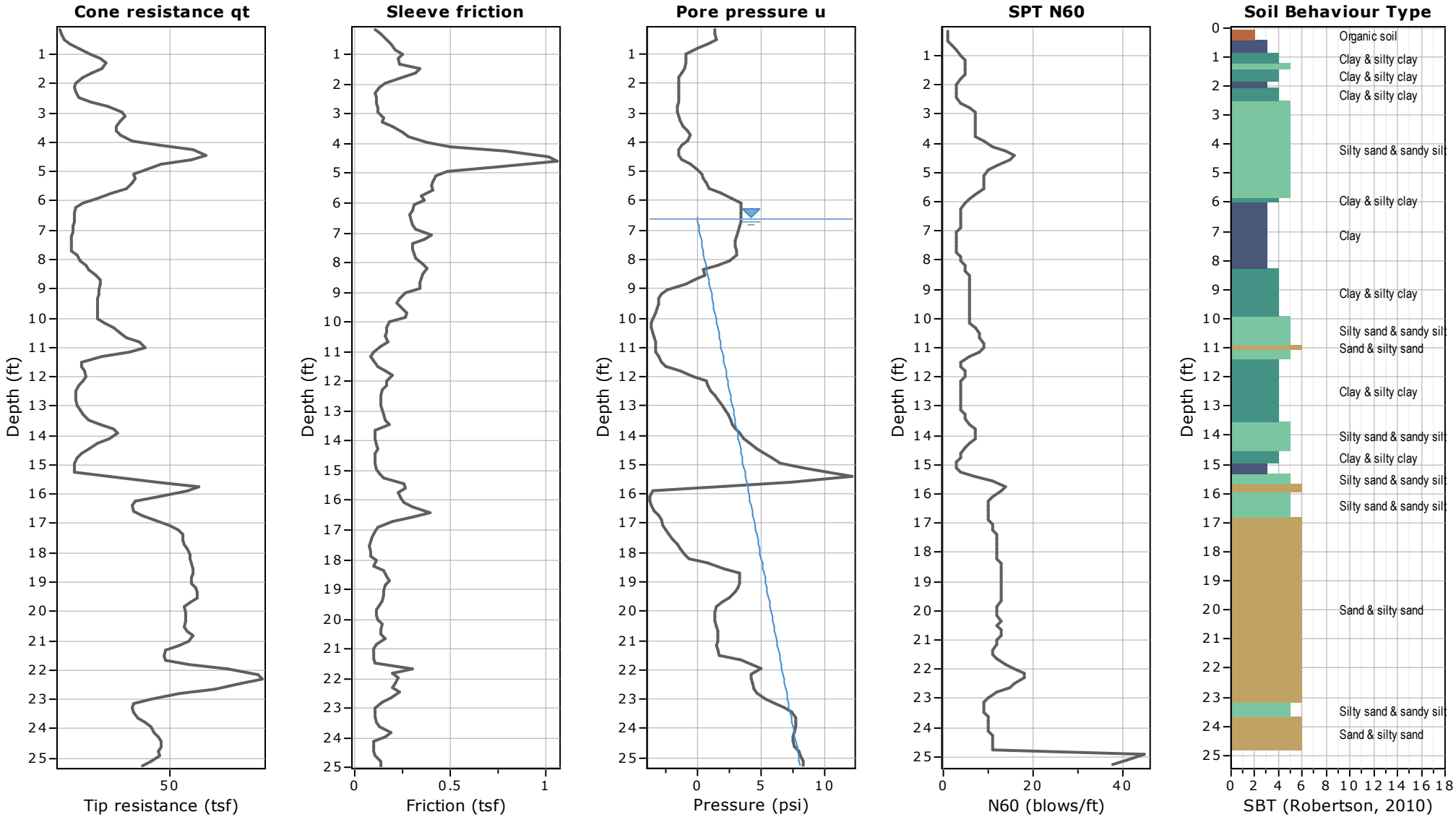
CPT: S-16
Total depth: 25.26 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

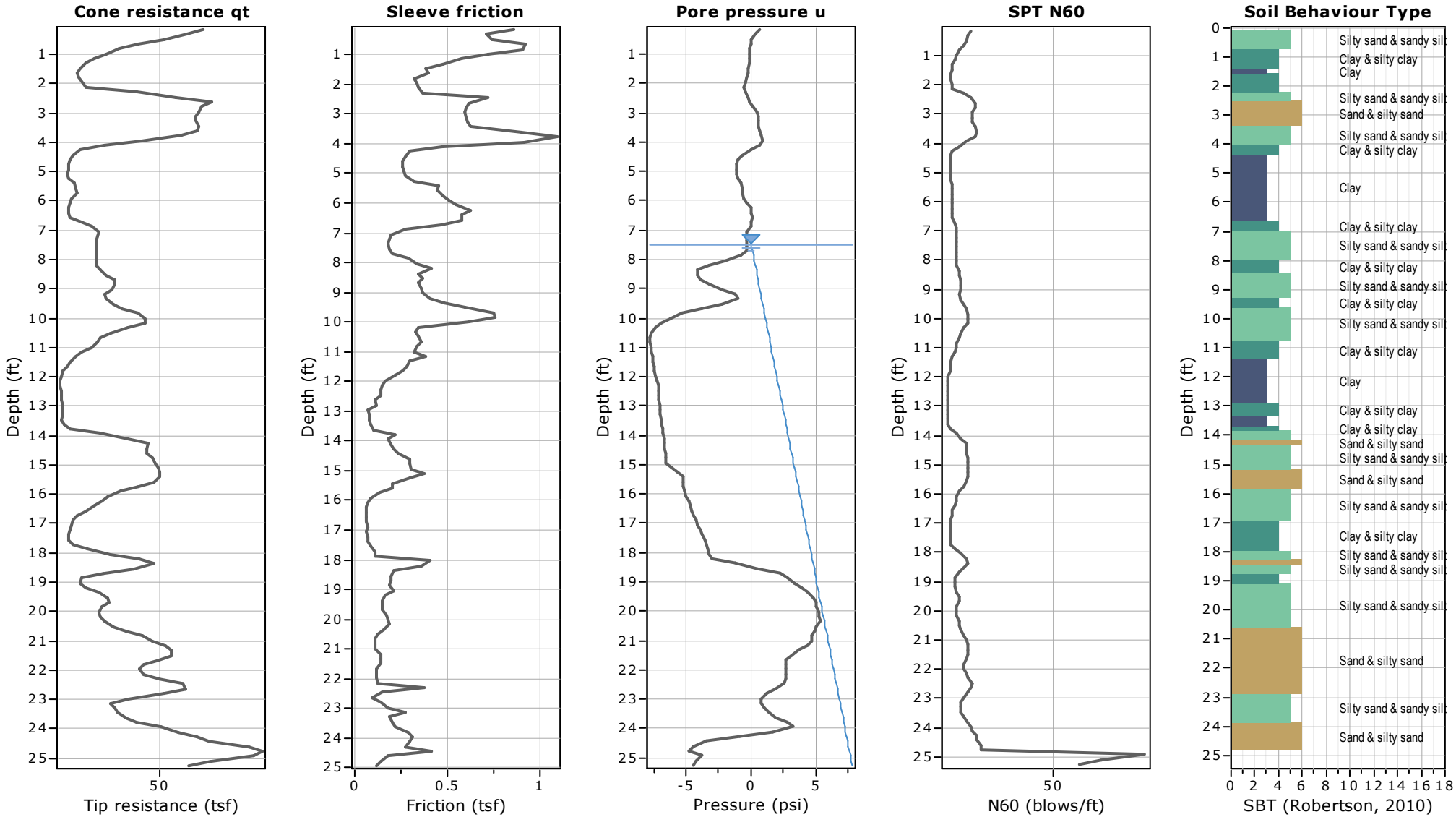
CPT: S-17
Total depth: 25.26 ft, Date: 12/4/2017



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ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

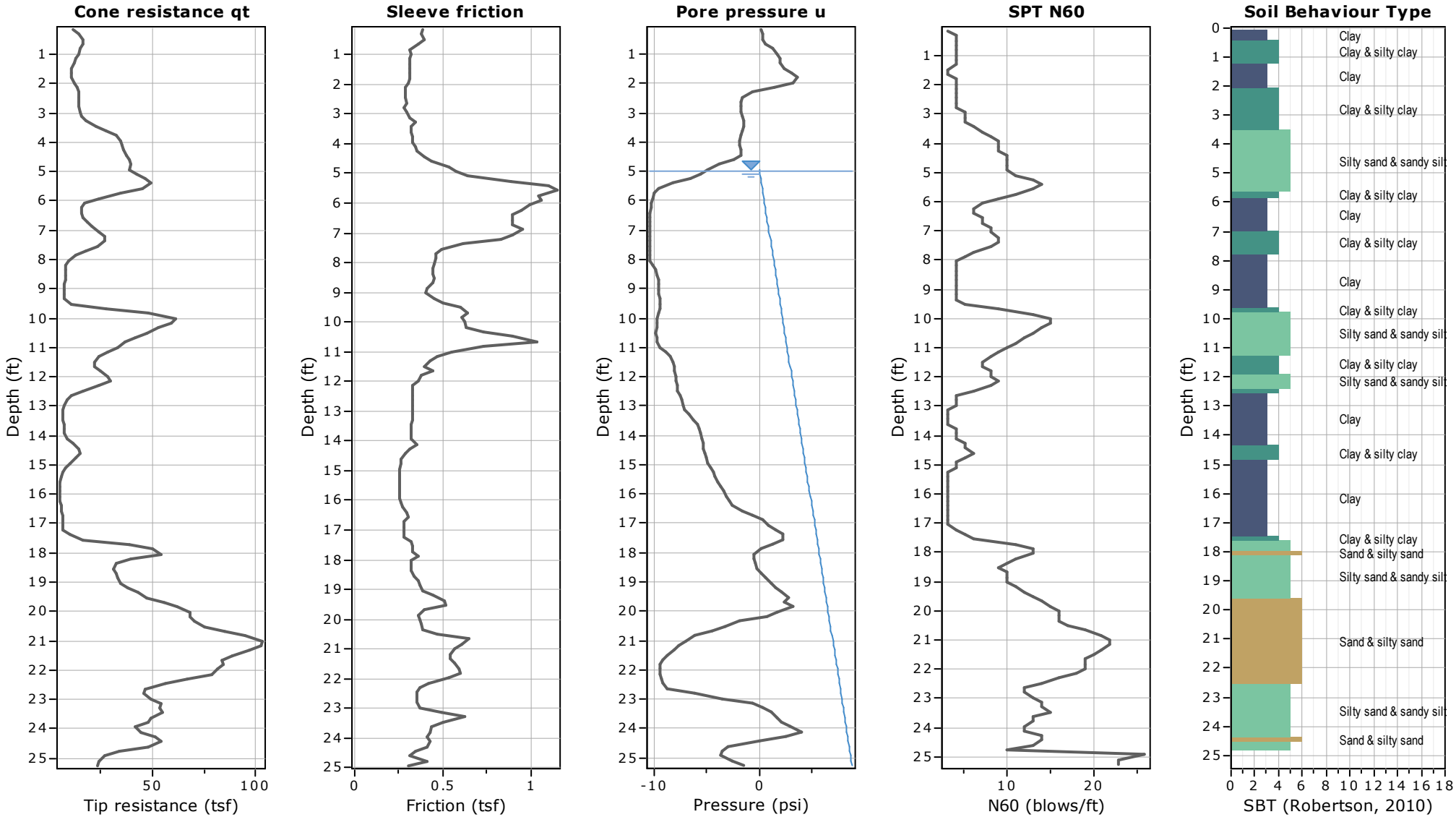
CPT: S-18
Total depth: 25.26 ft, Date: 12/4/2017



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ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

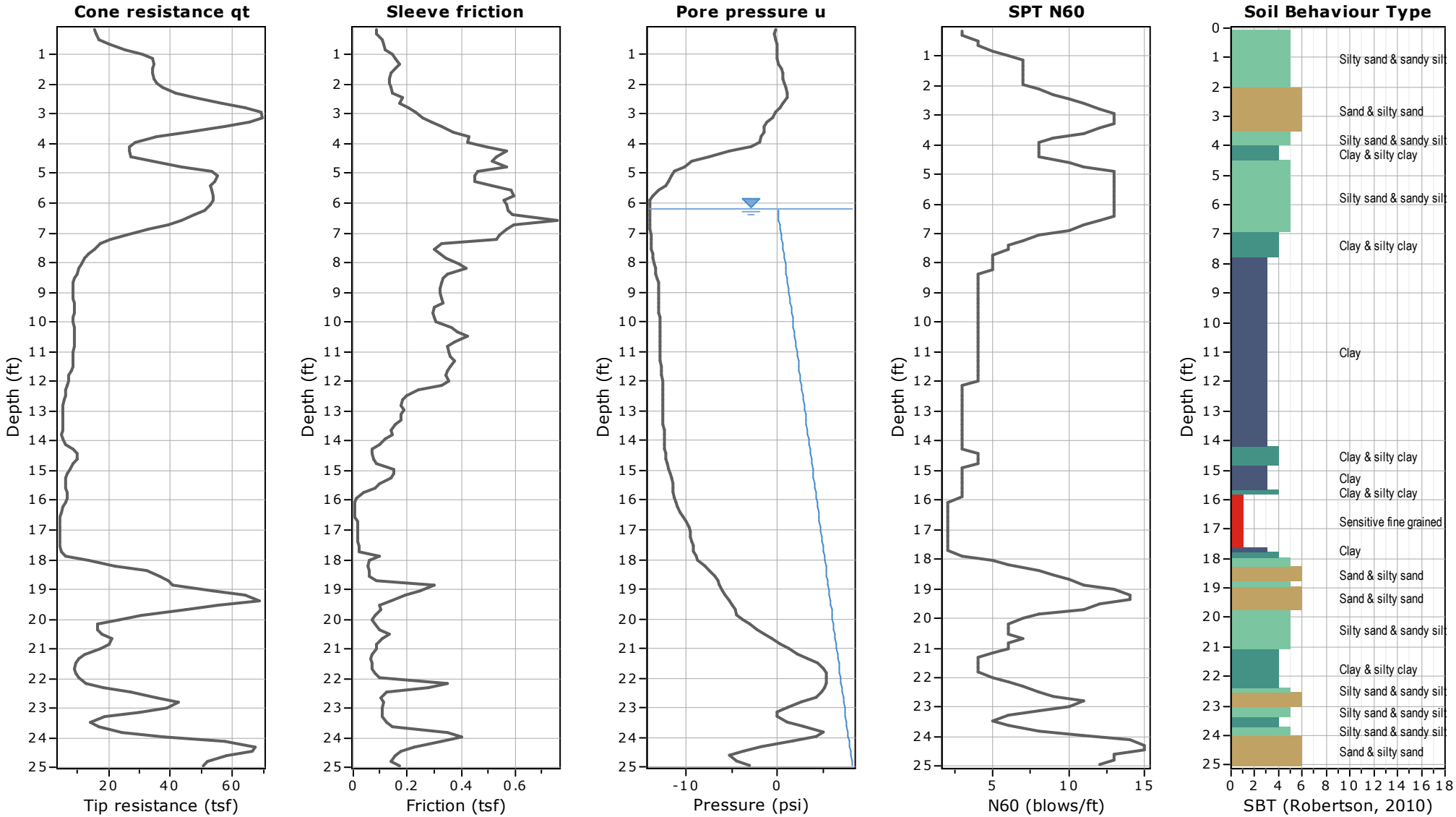
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Total depth: 25.26 ft, Date: 12/4/2017



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Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

CPT: S-20
Total depth: 24.93 ft, Date: 12/4/2017



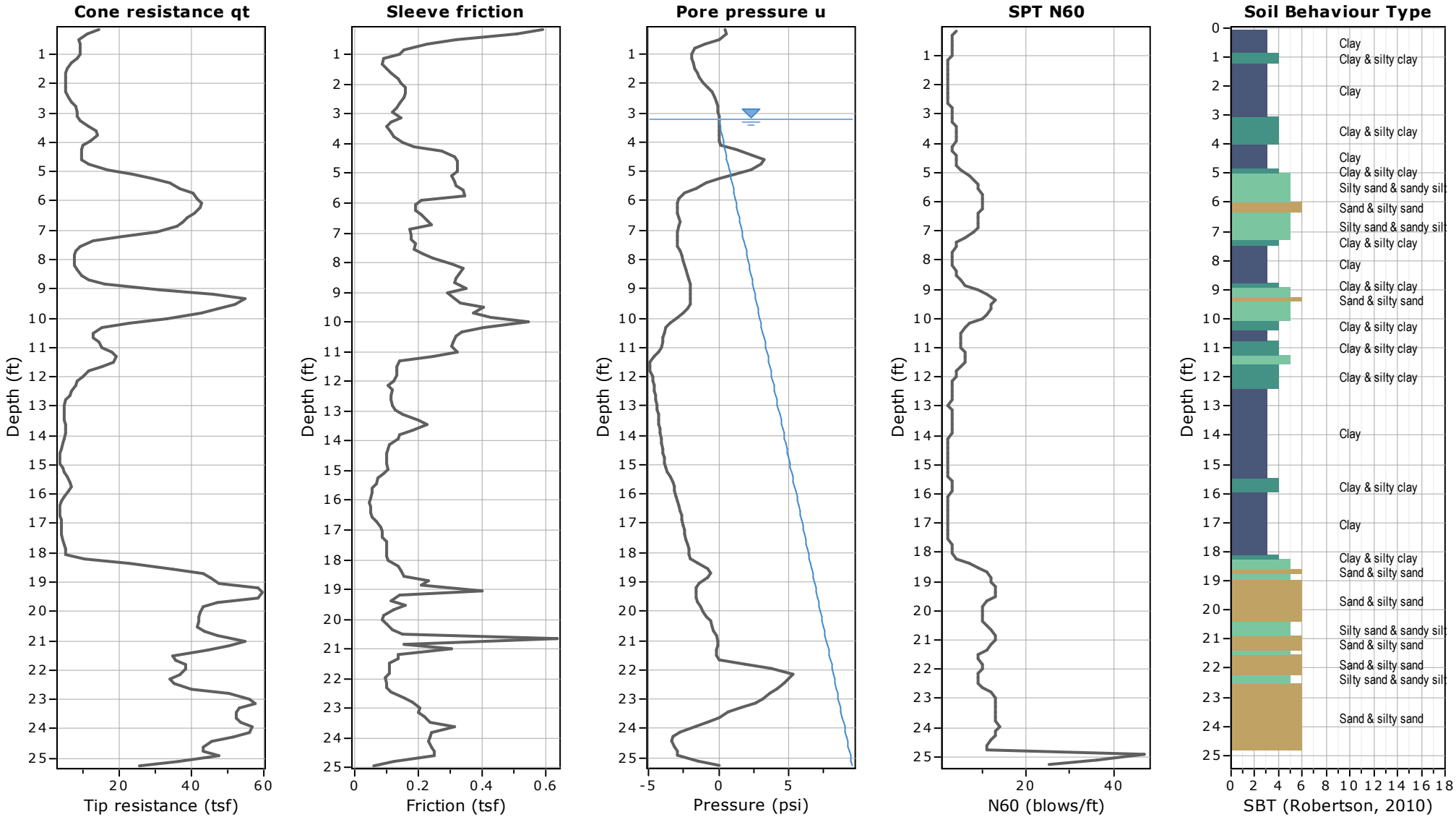
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Wilmington, NC 28405
ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**

Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

CPT: S-21

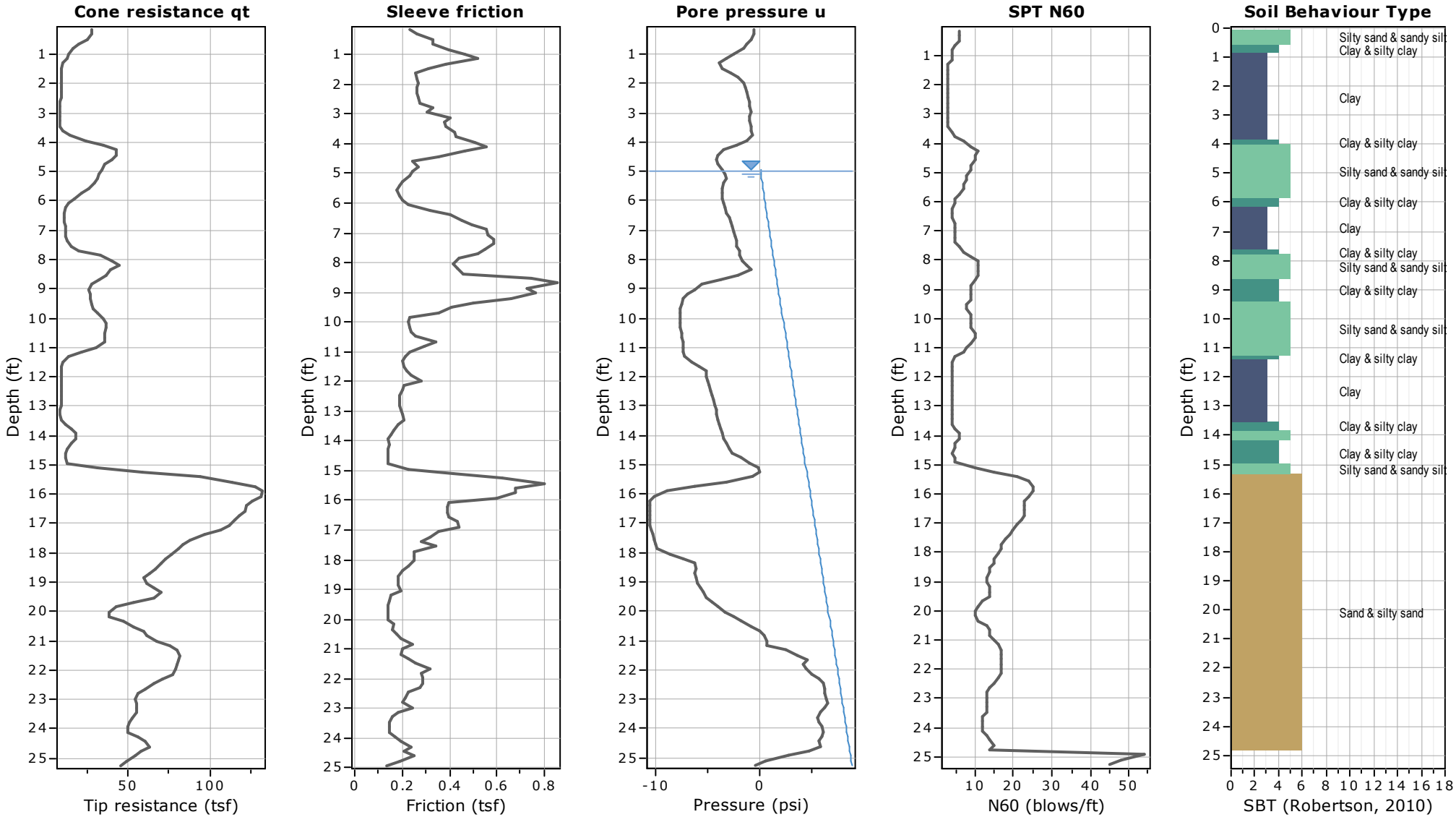
Total depth: 25.26 ft, Date: 12/4/2017



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Wilmington, NC 28405
ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

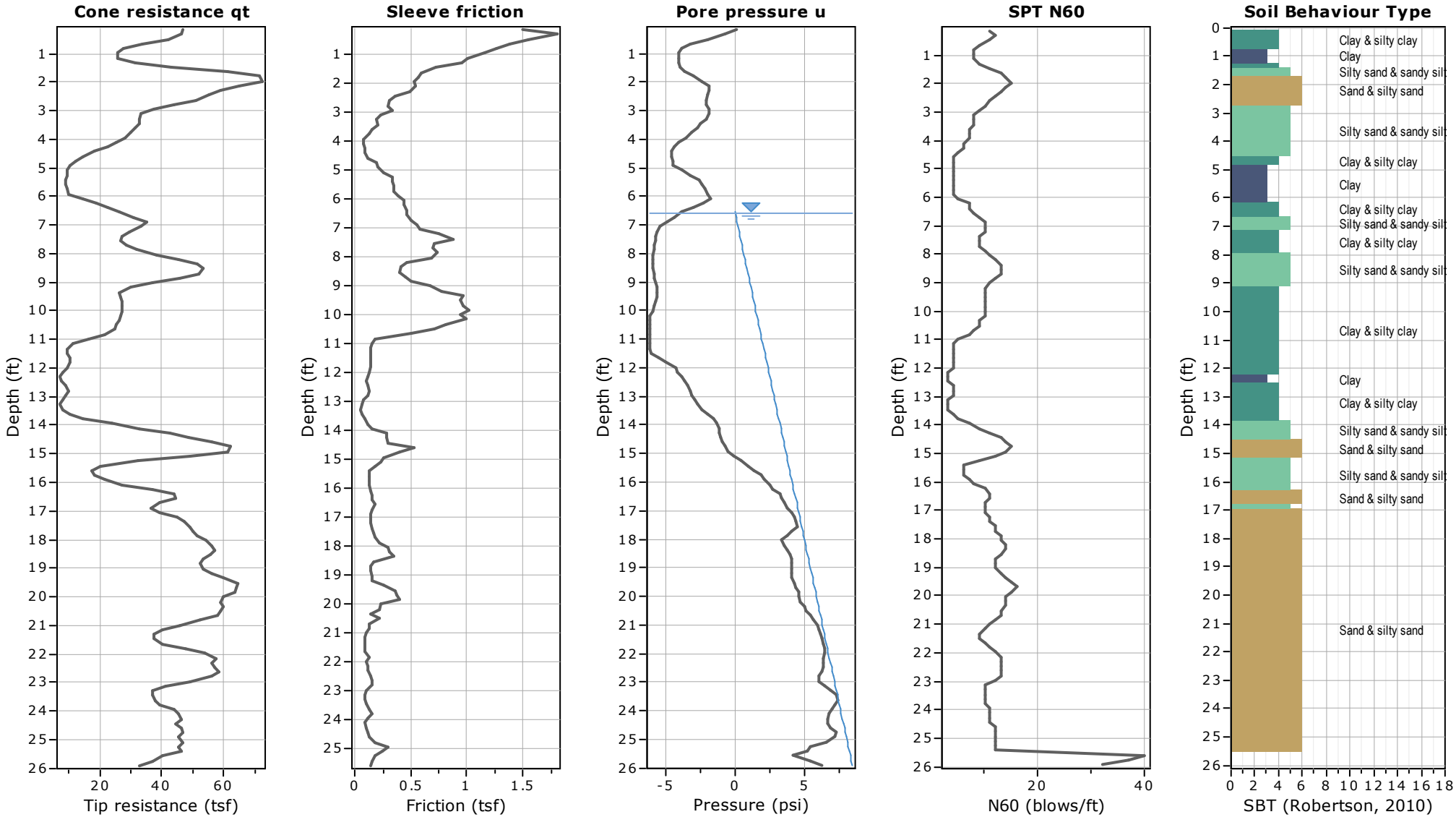
CPT: S-22
Total depth: 25.26 ft, Date: 12/4/2017



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ECS Project # 22-25758

Project: **Town Creek Elementary/Middle School**
Location: **6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina**

CPT: S-23
Total depth: 25.92 ft, Date: 12/4/2017



DCP TEST DATA

Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

Location: K-1 **Soil Type(s):** Sandy Clay, Silty and Clayey Sand

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	254	1
5	419	1
5	610	1
1	673	1
		1
		1

DCP TEST DATA

Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

Location: K-2 **Soil Type(s):** Clayey Sand

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	691	1
		1
		1

DCP TEST DATA

File Name:

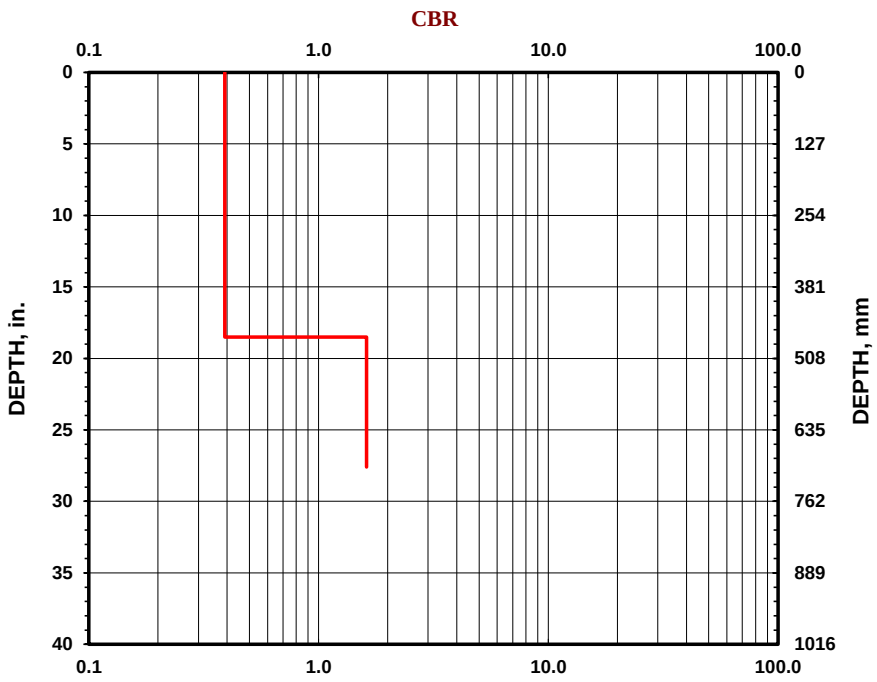
Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

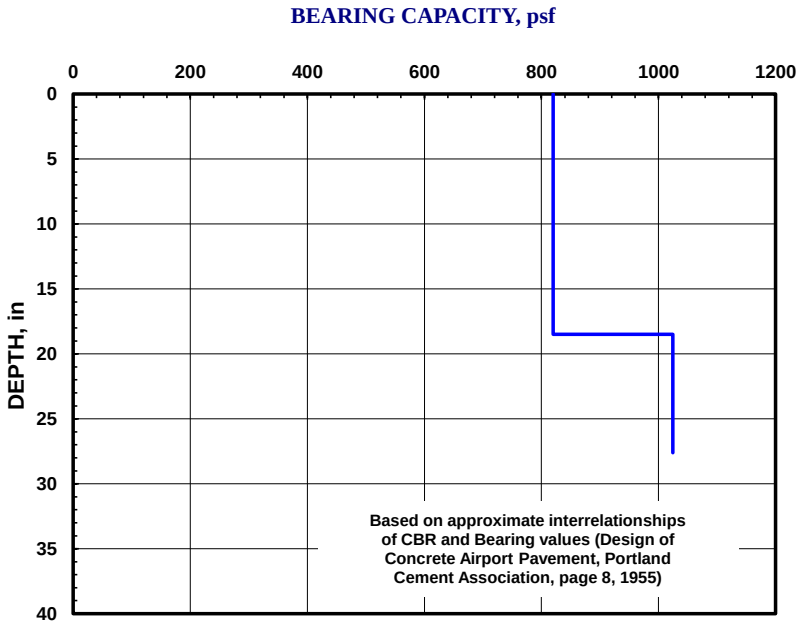
Location: K-3 **Soil Type(s):** Low plasticity Clay with CBR<10

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ◉ CL
- ○ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
5	470	1
5	701	1





DCP TEST DATA

File Name:

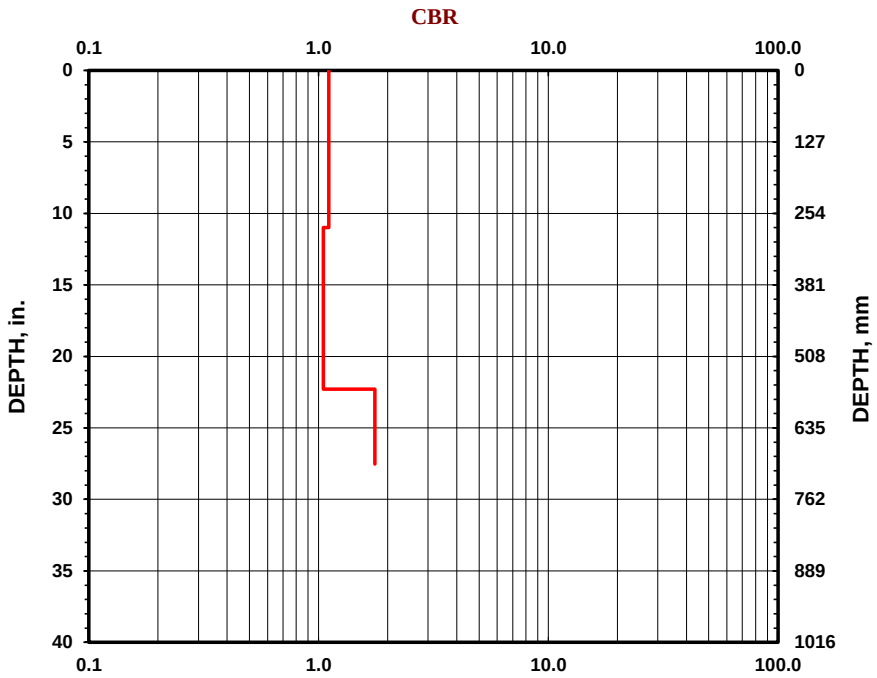
Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

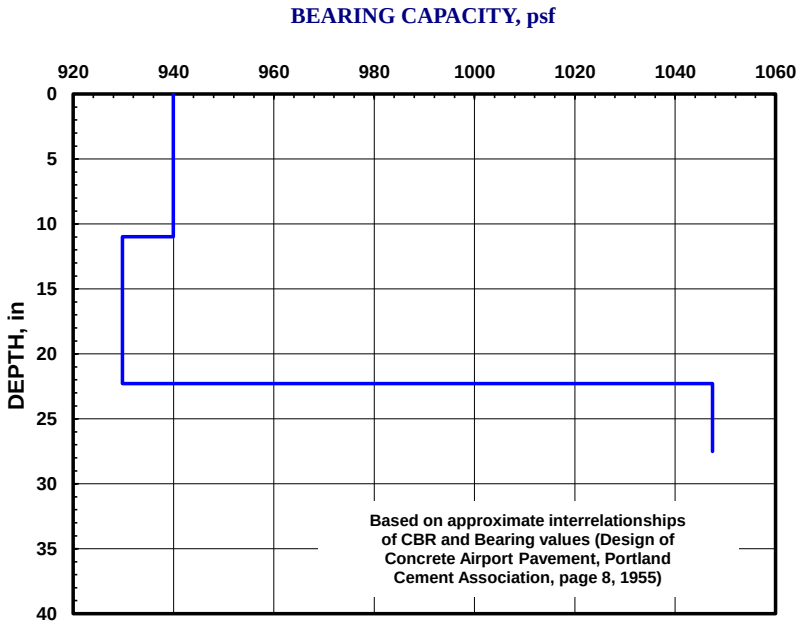
Location: K-4 **Soil Type(s):** Low plasticity Clay with CBR<10

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ◉ CL
- ○ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
5	279	1
5	566	1
3	699	1





DCP TEST DATA

File Name:

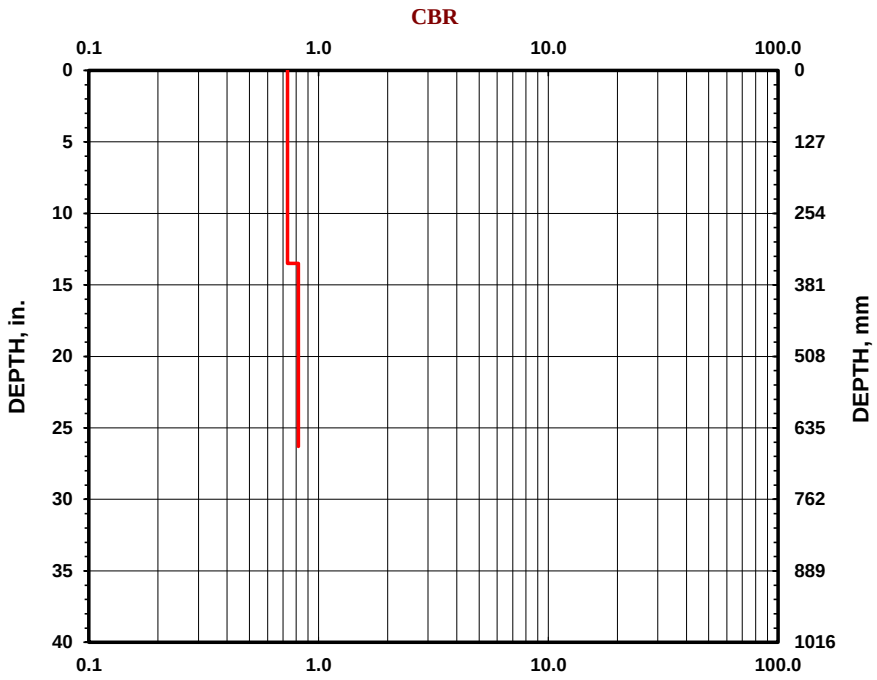
Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

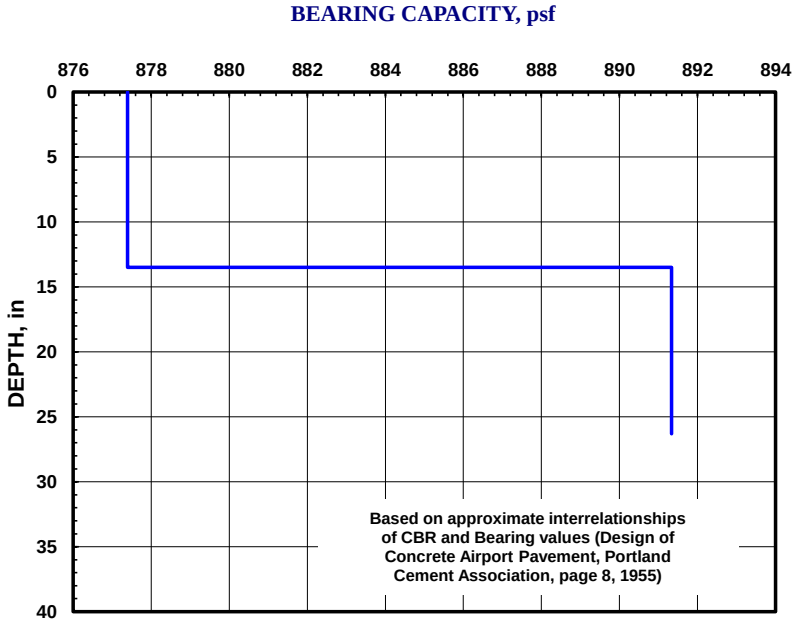
Location: K-5 **Soil Type(s):** Low plasticity Clay with CBR<10

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ◉ CL
- ○ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
5	343	1
5	668	1





DCP TEST DATA

Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

Location: K-6 **Soil Type(s):** Silty Sand and Sandy Clay

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	422	1
5	663	1
		1
		1

DCP TEST DATA

Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

Location: K-7 **Soil Type(s):** Silty Sand and Sandy Clay

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	89	1
5	152	1
5	259	1
5	345	1
5	409	1
5	516	1
5	711	1
		1
		1

DCP TEST DATA

File Name:

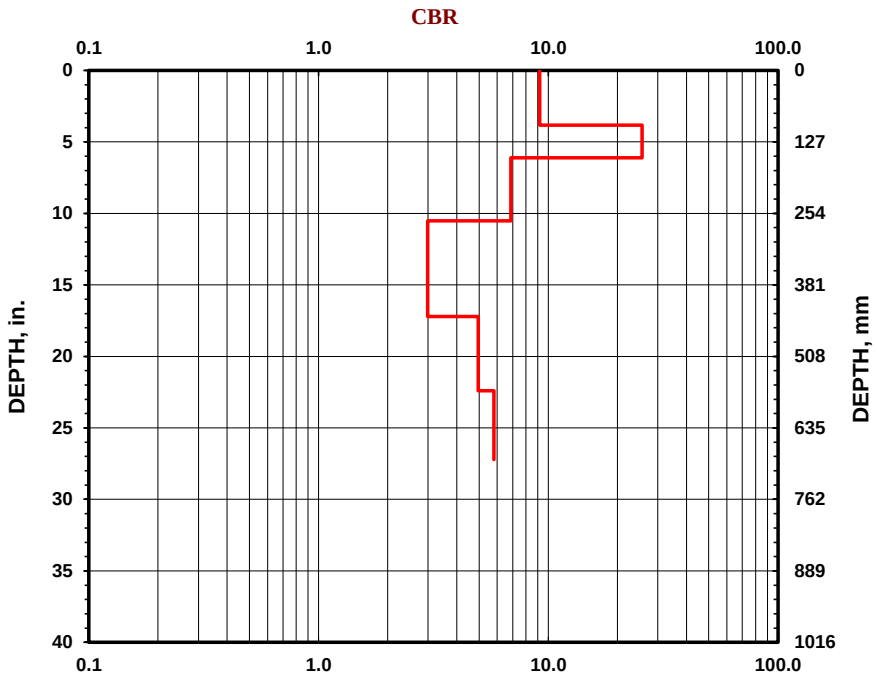
Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

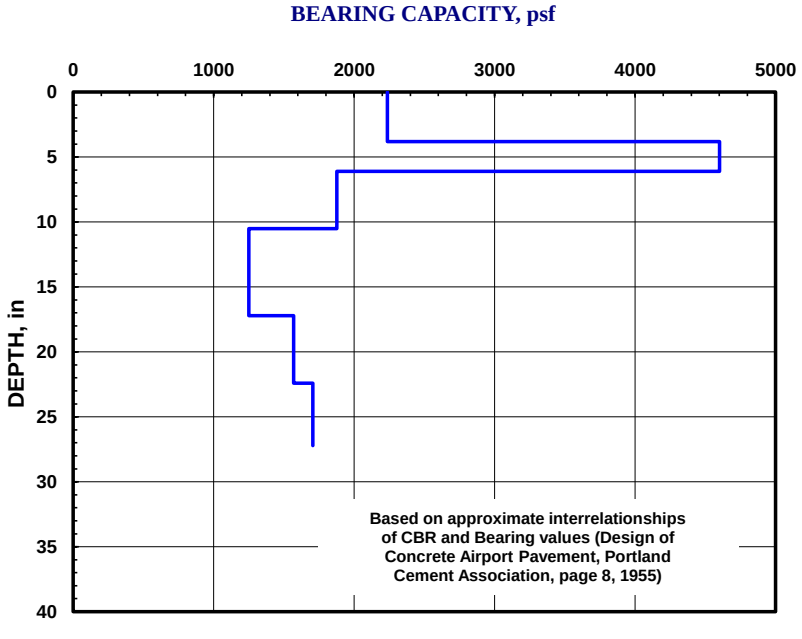
Location: K-8 **Soil Type(s):** Low plasticity Clay with CBR<10

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ◉ CL
- ○ All other soils

No. of Blows	Accumulative Penetration (mm)	Type of Hammer
0	0	1
5	97	1
5	155	1
5	267	1
5	437	1
5	569	1
5	691	1





DCP TEST DATA

Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

Location: K-9 **Soil Type(s):** Clean Sand

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	198	1
5	353	1
5	572	1
2	673	1
		1
		1

DCP TEST DATA

Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

Location: K-10 **Soil Type(s):** Sandy Clay and Clean Sand

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	206	1
5	330	1
5	399	1
5	500	1
5	704	1
		1
		1

DCP TEST DATA

Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

Location: K-11 **Soil Type(s):** Silty and Clean Sand

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	218	1
5	297	1
5	345	1
5	381	1
5	445	1
5	521	1
5	566	1
5	584	1
5	622	1
5	643	1
5	660	1
		1
		1

DCP TEST DATA

Project: *Town Creek Middle/Elementary School* **Date:** 22-Nov-17

Location: K-12 **Soil Type(s):** Silty and Clean Sand

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

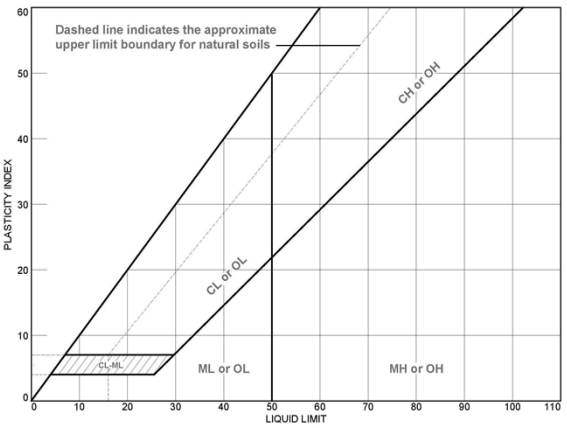
Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	221	1
5	401	1
5	500	1
5	627	1
5	699	1
		1
		1

Unified Soil Classification System
(ASTM Designation D-2487)

Major Division			Group Symbol	Typical Names	Classification on basis of percentage of fines	Classification Criteria
Coarse-grained soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve		GW	Well-graded gravels and gravel-sand mixtures, little or no fines	GW, GP, SW, SP GM, GC, SM, SC Borderline classification requiring use of dual symbol	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = (D_{30})^2/(D_{10}xD_{60})$ Between 1 and 3
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW
			GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7
	Sands More than 50% of coarse fraction passes No. 4 sieve		SW	Well-graded sands and gravelly sands, little or no fines	Less than 5% Pass No. 200 sieve More than 12% Pass No. 200 sieve 5% to 12% Pass No. 200 sieve	$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = (D_{30})^2/(D_{10}xD_{60})$ Between 1 and 3
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW
			SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7
Fine-grained soils 50% or more passing No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts		
			CH	Inorganic clays of high plasticitiy, fat clays		
			OH	Organic clays of medium to high plasticity		
Highly organic soils			Pt	Peat, muck and other highly organic soils		Fibrous organic matter; will char, burn, or glow

Note: U-line represents approximate upper limit of LL and PI combinations for natural soils (empirically determined). ASTM-D2487.



Plasticity chart for the classification of fine-grained soils.
Tests made on fraction finer than No. 40 sieve

UNIFIED SOIL CLASSIFICATION SYSTEM

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [8"]			
1					(SM) SILTY FINE SAND, orange, moist			
2								
3					(SC) CLAYE FINE SAND, orange to gray, moist			
4					(CL) SANDY LEAN CLAY, orange to gray, moist			
5					END OF BORING@ 4.0'			
6								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0							
1							
2							
3							
					▽		
4							
5							
6							

Topsoil/Rootmat Depth [8"]

(SC) CLAYEY FINE TO MEDIUM SAND, tan to gray, moist to saturated

END OF BORING @ 4.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

▽ WL 3.5 WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
▽ WL(SHW) ▼ WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
▽ WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-3	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [6"]			
1					(CL) SANDY LEAN CLAY, orange to gray, moist to saturated			
2								
3						▽		
4					END OF BORING @ 4.0'			
5								
6								

BOTTOM OF CASING ▰ LOSS OF CIRCULATION

SURFACE ELEVATION

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

▽ WL 3.5 WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
▽ WL(SHW) ▼ WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
▽ WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-4	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [6"]			
1					(CL) SANDY LEAN CLAY, oragne to gray, moist to saturated			
2								
3						▽		
4					END OF BORING @ 4.0'			
5								
6								

BOTTOM OF CASING ▰ LOSS OF CIRCULATION

SURFACE ELEVATION

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

▽ WL 3.5 WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
▽ WL(SHW) ▼ WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
▽ WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-5	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [8"]			
1					(CL) SANDY LEAN CLAY, orange to gray, moist to saturated			
2								
3								
4					END OF BORING @ 4.0'			
5								
6								

BOTTOM OF CASING | LOSS OF CIRCULATION | SURFACE ELEVATION

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 3.8 WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-6	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS; BOTTOM OF CASING; LOSS OF CIRCULATION; SURFACE ELEVATION)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [6"]			
1					(SM) SILTY FINE SAND, orange, moist			
2					(CL) SANDY LEAN CLAY, orange to gray, moist			
3								
4					END OF BORING@ 4.0'			
5								
6								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS☐ WD☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-7	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [4"]			
					(SM) SILTY FINE SAND, gray, moist			
1								
2					(SC) CLAYEY FINE SAND, orange to gray, moist			
3								
4					END OF BORING @ 4.0'			
5								
6								

BOTTOM OF CASING ▰ LOSS OF CIRCULATION

SURFACE ELEVATION

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-8	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat [4"]			
					(CL) SANDY LEAN CLAY, orange to gray, moist			
1								
2								
3								
4					END OF BORING @ 4.0'			
5								
6								

BOTTOM OF CASING | LOSS OF CIRCULATION | SURFACE ELEVATION

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-9	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION

6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [6"]			
1					(SP Probable Fill) FINE TO MEDIUM SAND, gray, moist			
2								
3								
4					END OF BORING @ 4.0'			
5								
6								

BOTTOM OF CASING ➧ LOSS OF CIRCULATION

SURFACE ELEVATION

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-10	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [4"]			
					(SP/GP Probable Fill) FINE TO MEDIUM SAND AND GRAVEL, brown, moist			
1					(SP Probble Fill) FINE TO MEDIUM SAND, tan to gray, moist			
2								
3								
					(CL) SANDY LEAN CLAY, orange to gray, moist			
4					END OF BORING @ 4.0'			
5								
6								

BOTTOM OF CASING | LOSS OF CIRCULATION | SURFACE ELEVATION

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-11	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS; BOTTOM OF CASING; LOSS OF CIRCULATION; SURFACE ELEVATION)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [4"]			
					(SP Probable Fill) FINE TO MEDIUM SAND WITH CLAY LENSES, oragne to gray, moist			
1								
2					(SM) SILTY FINE SAND WITH CLAY LENSES, gray, moist			
3								
4					END OF BORING @ 4.0'			
5								
6								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	K-12	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary School	

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [6"]			
1					(SM) SILTY FINE SAND WITH CLAY LENSES, gray to brown, moist			
2					(SP) FINE SAND WITH ROOTS, gray to brown, moist			
3					(SM) SILTY FINE SAND, brown to gray, moist			
4					END OF BORING @ 4.0'			
5								
6								

BOTTOM OF CASING | LOSS OF CIRCULATION (100%) | SURFACE ELEVATION

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL WS ☐ WD ☐	BORING STARTED 11/22/17	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 11/22/17	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	DP-1	1 OF 1

PROJECT NAME: Town Creek Middle/Elementary Shool

ARCHITECT-ENGINEER:

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					BOTTOM OF CASING; LOSS OF CIRCULATION (100%); SURFACE ELEVATION			
					TOPSOIL (11")			
					(SC) CLAYEY FINE SAND, tan/gray, moist			
4					(CL) SANDY LEAN CLAY, gray/orange, moist			
					(CH) SILTY FAT CLAY, gray, moist to wet	▽		
					(SM) SILTY FINE SAND, wet, trace clay			
8					(CH) SILTY FAT CLAY, gray, wet			
					(SM) SILTY FINE TO MEDIUM SAND, gray to orange, wet, trace clay			
12					(CH) SILTY FAT CLAY, gray/red, wet			
					(CL) SANDY LEAN CLAY, tan/gray/blue, wet			
					(SC) CLAYEY FINE TO MEDIUM SAND, dark gray/blue, wet			
16					HIGHLY WEATHERD LIMESTONE, sampled as fine to coarse sand with gravel and shells, gray, saturated			
					BORING TERMINATED @ 16.0'			
20								
24								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

▽ WL 6 WS ☐ WD ☐	BORING STARTED 11-30-17	CAVE IN DEPTH
▽ WL(SHW) ▼ WL(ACR)	BORING COMPLETED 11-30-17	HAMMER TYPE
▽ WL	RIG FOREMAN RS	DRILLING METHOD Direct Push Boring

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	DP-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
Town Creek Middle/Elementary Shool	

SITE LOCATION

6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					TOPSOIL (12")			
					(SC) CLAYEY FINE SAND, dark brown, moist, trace roots			
					(CL) SILTY LEAN CLAY, gray/orange, moist			
4					(CH) SILTY FAT CLAY, gray/orange, moist to wet			
8						▽		
					(CL) SILTY LEAN CLAY, gray/tan, wet, trace sand			
12					(CH) SILTY FAT CLAY, gray, wet			
					(CL) SANDY LEAN CLAY, gray/orange, wet			
					(CH) SILTY FAT CLAY, gray/dark gray, wet			
16					(SM) SILTY FINE SAND, gray, trace clay			
					BORING TERMINATED @ 16.0'			
20								
24								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

▽ WL 7.5 WS ☐ WD ☐	BORING STARTED 11-30-17	CAVE IN DEPTH
▽ WL(SHW) ▼ WL(ACR)	BORING COMPLETED 11-30-17	HAMMER TYPE
▽ WL	RIG FOREMAN RS	DRILLING METHOD Direct Push Boring

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:25758	DP-3	1 OF 1

PROJECT NAME: Town Creek Middle/Elementary Shool

ARCHITECT-ENGINEER:

SITE LOCATION: 6330 Lake Park Dr, Winnabow, Brunswick County, North Carolina

NORTHING | EASTING | STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL (ENGLISH UNITS)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					BOTTOM OF CASING; LOSS OF CIRCULATION 100% SURFACE ELEVATION TOPSOIL (6")			
					(SM) SILTY FINE TO MEDIUM SAND, brown tan/, moist			
					(SC) CLAYEY FINE TO MEDIUN SAND, tan, moist			
					(CL) SANDY LEAND CLAY, tan/gray/orange, moist			
4					(CH) SILTY FAT CLAY, gray/orange, moist to wet	▽		
8					(CL) SILTY LEAN CLAY, gray, wet, trace sand			
					(CH) SILTY FAT CLAY, gray/dark gray, wet			
12					(SM) SILTY FINE TO MEDIUM SAND, gray, wet, trace clay			
					(CL) SANDY LEAN CLAY, tan/gray, wet			
					(CH) SILTY FAT CLAY, gray, wet			
16					(SM) SILTY FINE SAND, gray, wet, trace clay			
					BORING TERMINATED @ 16.0'			
20								
24								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

▽ WL 6.5 WS ☐ WD ☐	BORING STARTED 11-30-17	CAVE IN DEPTH
▽ WL(SHW) ▼ WL(ACR)	BORING COMPLETED 11-30-17	HAMMER TYPE
▽ WL	RIG FOREMAN RS	DRILLING METHOD Direct Push Boring

APPENDIX C – SHWT and Infiltration Report

SHWT and Infiltration Report

December 15, 2017

Mr. Craig Eckert
Brunswick County Schools
35 Referendum Drive
Bolivia, North Carolina 28422

Reference: Report of Seasonal High Water Table Estimation and Infiltration Testing
Town Creek Schools
Winnabow, Brunswick County, North Carolina
ECS Project No. 22.25758

Dear Mr. Eckert:

ECS Southeast, LLP (ECS) recently conducted a seasonal high water table (SHWT) estimation and infiltration testing within the stormwater control measure (SCM) area(s) at 6330 Lake Park Drive in Winnabow, Brunswick County, North Carolina. This letter, with attachments, is the report of our testing.

Field Testing

On December 12th and 13th, ECS conducted an exploration of the subsurface soil and groundwater conditions at eight requested locations shown on the attached Boring Location Plan (Figure 1). ECS located the boring locations using GPS equipment. The purpose of this exploration was to obtain subsurface information of the in situ soils for the SCM area(s). ECS explored the subsurface soil and groundwater conditions by advancing one hand auger boring into the existing ground surface at each of the requested boring locations. ECS visually classified the subsurface soils and obtained representative samples of each soil type encountered. ECS also recorded the SHWT and groundwater elevation observed at the time of the hand auger borings. The attached Infiltration Testing Form provides a summary of the subsurface conditions encountered at the hand auger boring locations.

The SHWT and groundwater elevation was estimated at the boring locations below the existing grade elevation. A summary of the findings are as follows:

Location	SHWT	Groundwater
I-1	10 inches	24 inches
I-2	16 inches	32 inches
I-3	24 inches	36 inches
I-4	22 inches	40 inches
I-5	14 inches	20 inches
I-6	12 inches	24 inches
I-7	18 inches	36 inches
I-8	16 inches	24 inches

ECS has conducted eight infiltration tests utilizing a compact constant head permeameter near the hand auger borings in order to estimate the infiltration rate for the subsurface soils. Infiltration tests are typically conducted at two feet above the SHWT or in the most restrictive soil horizon. Tests in clayey conditions are conducted for durations of up to 30 minutes. If a more precise hydraulic conductivity value is desired for these locations, then ECS recommends collecting samples by advancing Shelby tubes and performing laboratory permeability testing.

Field Test Results

Below is a summary of the infiltration test results:

Location	Description	Depth	Inches/ hour
I-1	Gray silty SAND	14 inches	0.024
I-2	Tan/gray clayey SAND	10 inches	0.006
I-3	Black silty SAND	10 inches	0.039
I-4	Orange/gray CLAY	24 inches	<0.001
I-5	Tan/gray clayey SAND	12 inches	0.011
I-6	Tan/orange/gray sandy CLAY	12 inches	<0.001
I-7	Tan/orange/gray sandy CLAY	12 inches	<0.001
I-8	Tan/orange/gray sandy CLAY	18 inches	<0.001

Infiltration rates and SHWT may vary within the proposed site due to changes in elevation and subsurface conditions.

Closure

ECS's analysis of the site has been based on our understanding of the site, the project information provided to us, and the data obtained during our exploration. If the project information provided to us is changed, please contact us so that our recommendations can be reviewed and appropriate revisions provided, if necessary. The discovery of any site or subsurface conditions during construction which deviate from the data outlined in this exploration should be reported to us for our review, analysis and revision of our recommendations, if necessary. The assessment of site environmental conditions for the presence of pollutants in the soil and groundwater of the site is beyond the scope of this geotechnical exploration.

ECS appreciates the opportunity to provide our services to you on this project. If you have any questions concerning this report or this project, please contact us.

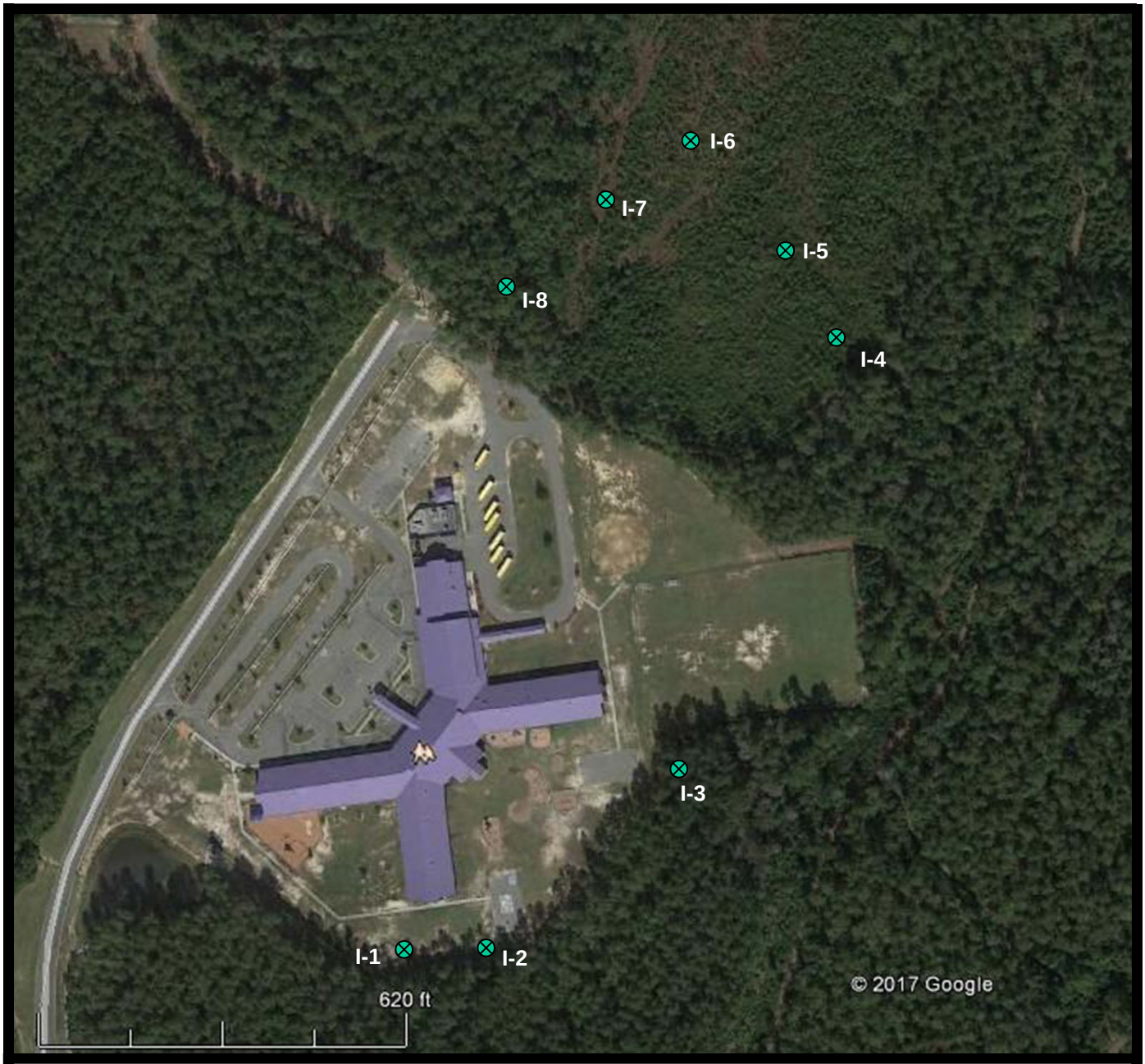
Respectfully,

ECS SOUTHEAST, LLP

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Attachments: Figure 1 - Boring Location Plan
Infiltration Testing Form
ASFE Document



⊗ **APPROXIMATE BORING LOCATIONS**

SCALE SHOWN ABOVE

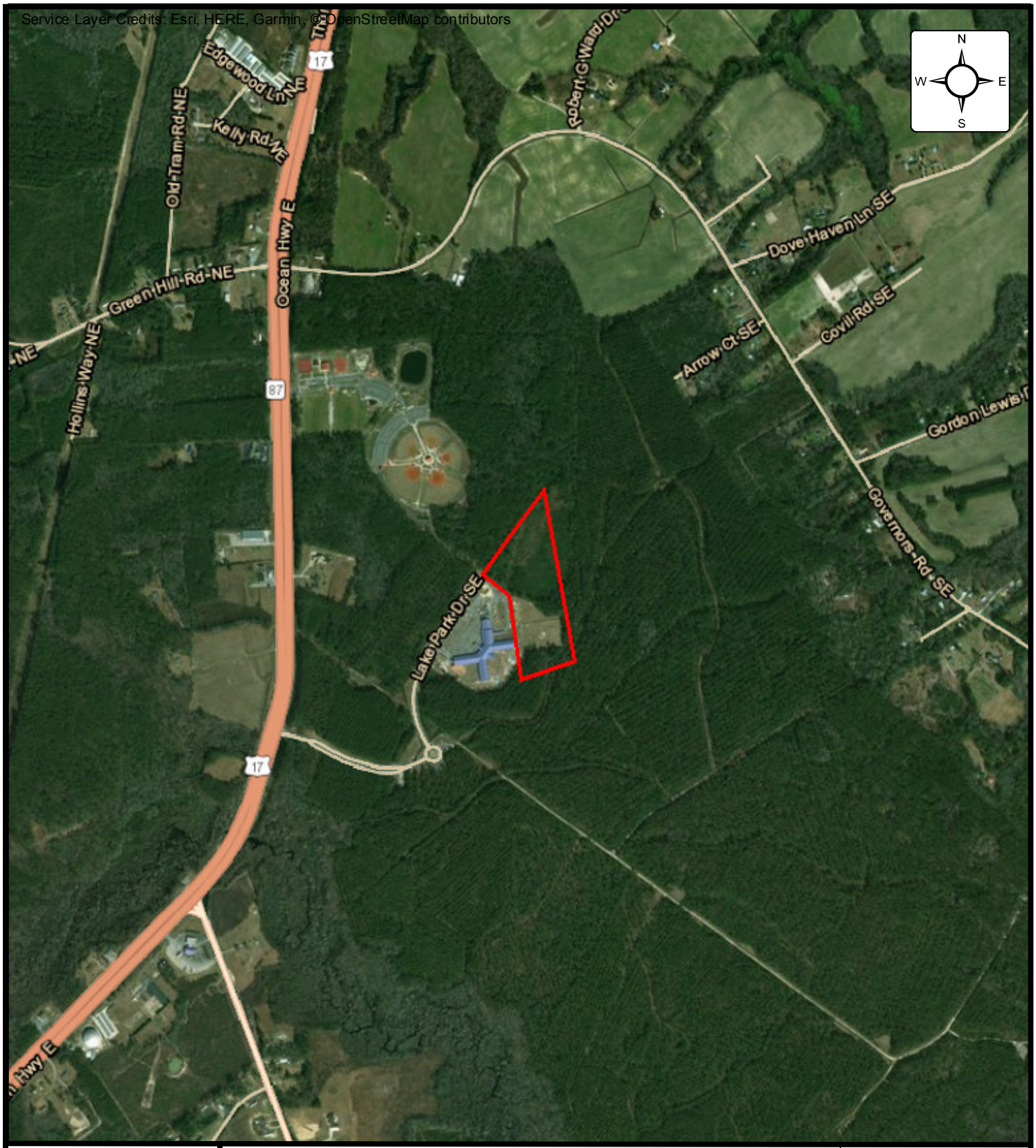
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Town Creek Schools
Winnabow, Brunswick County,
North Carolina

ECS Project # 22.25785
October 22, 2017
KBW

Figure 1– Boring Location Plan

Provided by: Google Earth



SITE LOCATION DIAGRAM

TCMS - FIRE LANE

WINNABOW, NORTH CAROLINA

ENGINEER	WEG
SCALE	NTS
PROJECT NO.	22:26426
SHEET	1 OF 2
DATE	3/6/2018

Infiltration Testing Form
Town Creek Schools
Winnabow, Brunswick County, North Carolina
ECS Project No. 22.25785
December 12th and 13th, 2017

Location	Depth	USCS	Soil Description
I-1	0-13”	SW	Tan/gray fine SAND w/silt
	13”-30”	SM	Tan/orange clayey SAND

Seasonal High Water Table was estimated to be at 10 inches below the existing grade elevation.
Groundwater was encountered at 24 inches below the existing grade elevation.
Test was conducted at 14 inches below existing grade elevation
Infiltration Rate: 0.024 inches per hour

Location	Depth	USCS	Soil Description
I-2	0-36”	SC	Tan/gray clayey SAND

Seasonal High Water Table was estimated to be at 16 inches below the existing grade elevation.
Groundwater was encountered at 32 inches below the existing grade elevation.
Test was conducted at 10 inches below existing grade elevation
Infiltration Rate: 0.006 inches per hour

Location	Depth	USCS	Soil Description
I-3	0-12”	SM	Black silty SAND
	12”-36”	SW	Tan/orange fine SAND w/clay

Seasonal High Water Table was estimated to be at 24 inches below the existing grade elevation.
Groundwater was encountered at 36 inches below the existing grade elevation.
Test was conducted at 10 inches below existing grade elevation
Infiltration Rate: 0.039 inches per hour

Infiltration Testing Form
Town Creek Schools
Winnabow, Brunswick County, North Carolina
ECS Project No. 22.25785
December 12th and 13th, 2017

Location	Depth	USCS	Soil Description
I-4	0-22”	SC	Tan/orange clayey SAND
	22”-40”	CL	Orange/gray CLAY

Seasonal High Water Table was estimated to be at 22 inches below the existing grade elevation.
Groundwater was encountered at 40 inches below the existing grade elevation.
Test was conducted at 24 inches below existing grade elevation
Infiltration Rate: <0.001 inches per hour

Location	Depth	USCS	Soil Description
I-5	0-10”	SM	Black silty SAND
	12”-36”	SC	Tan/gray clayey SAND

Seasonal High Water Table was estimated to be at 14 inches below the existing grade elevation.
Groundwater was encountered at 20 inches below the existing grade elevation.
Test was conducted at 12 inches below existing grade elevation
Infiltration Rate: 0.011 inches per hour

Location	Depth	USCS	Soil Description
I-6	0-10”	SC	Gray clayey SAND
	10”-36”	CL	Tan/orange/gray sandy CLAY

Seasonal High Water Table was estimated to be at 12 inches below the existing grade elevation.
Groundwater was encountered at 24 inches below the existing grade elevation.
Test was conducted at 12 inches below existing grade elevation
Infiltration Rate: <0.001 inches per hour

Infiltration Testing Form
Town Creek Schools
Winnabow, Brunswick County, North Carolina
ECS Project No. 22.25785
December 12th and 13th, 2017

Location	Depth	USCS	Soil Description
I-7	0-10”	SC	Gray/brown clayey SAND
	10”-36”	CL	Tan/orange/gray sandy CLAY

Seasonal High Water Table was estimated to be at 18 inches below the existing grade elevation.
Groundwater was encountered at 36 inches below the existing grade elevation.
Test was conducted at 12 inches below existing grade elevation
Infiltration Rate: <0.001 inches per hour

Location	Depth	USCS	Soil Description
I-8	0-16”	SC	Gray/brown clayey SAND
	16”-36”	CL	Tan/orange/gray sandy CLAY

Seasonal High Water Table was estimated to be at 16 inches below the existing grade elevation.
Groundwater was encountered at 24 inches below the existing grade elevation.
Test was conducted at 18 inches below existing grade elevation
Infiltration Rate: <0.001 inches per hour

APPENDIX D – Supplemental Report Documents

ASFE Document

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes

The following information is provided to help you manage your risks.

Geotechnical 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 civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from alight industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- 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. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ-sometimes significantly from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of 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 equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in-this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer For Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
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e-mail: info@asfe.org www.asfe.org

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ECS SOUTHEAST, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities
NC Registered Engineering Firm F-1078
NC Registered Geologists Firm C-406
SC Registered Engineering Firm 3252

January 8, 2018

Mr. Craig Eckert
Brunswick County Schools
35 Referendum Drive
Bolivia, North Carolina 28422

ECS Project No. 22:25758

Reference: Geotechnical Engineering Addendum Letter
Town Creek Elementary/Middle School
6330 Lake Park Dr. SE
Winnabow, Brunswick County, North Carolina

Dear Mr. Eckert:

Referring to ECS Report No. 22.25758, dated December 20, 2017, the subjected site was given a seismic site classification of "F" due to the presence of liquefiable soils. A ground improvement system such as rammed aggregate piers or earthquake drains can be used to reduce the settlement of the liquefiable soils. It is recommended that a specialty contractor be consulted to design the ground improvement system. If a ground improvement system is installed to reduce the settlement caused by liquefaction, the seismic site classification of the site would change to "D".

Ground Motion Parameters: In addition to the seismic site classification noted above, ECS has determined the design spectral response acceleration parameters following the IBC 2009 methodology The Mapped Reponses were estimated from the free Java Ground Motion Parameter Calculator available from the USGS website. 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 (IBC 2009 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	0.323	F_a	1.542	$S_{MS}=F_aS_s$	0.497	$S_{DS}=2/3\ S_{MS}$	0.332
1.0	S_1	0.104	F_v	2.384	$S_{M1}=F_vS_1$	0.248	$S_{D1}=2/3\ S_{M1}$	0.165

The Site Class definition should not be confused with the Seismic Design Category designation, which the Structural Engineer typically assesses. If a probabilistic seismic hazard analysis (PSHA) is performed, a reduction of 20 percent of the S_{D1} would be required to achieve a reduction in the Seismic Design Category. Typically, in the area, we see a reduction of 12 to 15 percent with a PSHA.

Respectfully submitted,

ECS Southeast, LLP

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Winslow Goins, PE
Principal Engineer
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NC Registered Geologists Firm C-406
SC Registered Engineering Firm 3252

March 9, 2018

Mr. Craig Eckert
Brunswick County Schools
35 Referendum Drive
Bolivia, North Carolina 28422

ECS Project No. 22:26426

Reference: Geotechnical Engineering Letter
TCMS Fire Lane
6330 Lake Park Dr. SE
Winnabow, Brunswick County, North Carolina

Dear Mr. Eckert:

As requested, two (2) hand auger borings with Kessler Dynamic Cone Penetrometer (DCP) tests and seasonal high water table estimates were performed in the area of the proposed fire lane for the new Town Creek Middle School located near 6330 Lake Park Drive SE in Winnabow, Brunswick County, North Carolina. We understand that the proposed fire lane will be either pervious or impervious. If gravel/ABC stone is used for the fire lane, the fire lane should be considered impervious. If a pave geotextile is implemented (grass, porous aggregate, etc.) the fire lane can be considered pervious.

Groundwater Observations: The apparent groundwater depths were observed at the end of the work day and appeared to range from approximately 1.7 feet below ground surface. The groundwater levels are noted on the boring logs attached to this letter. The SHWT ranged from around 0.5 to 0.8 feet at the test locations. The SHWT report is attached to this letter.

Fire Lane Design Considerations: The in place subgrade soil can be modeled with a CBR value of 3. The fire lane will be designed with an ESAL of 75,000.

For a pervious fire lane, fire lane can utilize a porous paver system such as Grasspave2. The use of a porous paver system that is selected should be installed per manufacturer specifications and have a bearing capacity suitable to support a fire truck. An open graded base course utilizing sand or gravel should be used under the porous paver system. The thickness of the open graded base course should be based on the water storage determined by the Civil Engineer. After the open graded base course is placed, the geotextile can be placed and backfilled with sand in accordance with manufacturer specification.

For a gravel fire lane, the fire lane should be considered impervious and consist of at least 22 inches of ABC Stone. Alternatively, if approximately 2 feet of undercut is performed, the section can be reduced to 16 inches of ABC stone, and if TX140 geogrid is used, the section can be reduced to 10 inches of ABC stone.

For the design and construction of the fire lane, the subgrades should be prepared in strict accordance with the recommendations in the "Subgrade Preparation" and "Engineered Fill Placement" sections of this letter. For the pervious fire lane, the pavement design assumes subgrades consist of suitable materials evaluated by ECS and placed and compacted between 90% and 95% of the maximum dry density as determined by the standard Proctor test (ASTM D 698) in accordance with the project specifications. For the impervious fire lane, the pavement design assumes subgrades consist of suitable materials evaluated by ECS and placed and compacted to at least 98% of the maximum dry density as determined by the standard Proctor test (ASTM D 698) in accordance with the project specifications.

Subgrade Preparation: The subgrade preparation should consist of stripping all vegetation, rootmat, topsoil, existing fill, and any other soft or unsuitable materials from the 5-foot expanded pavement areas. ECS should be called on to verify that topsoil and unsuitable surficial materials have been completely removed prior to the placement of structural fill or construction of the fire lane.

After removing all unsuitable surface materials, cutting to the proposed grade, and prior to the placement of any structural fill or other construction materials, the exposed subgrade should be examined by the geotechnical engineer or authorized representative. The exposed subgrade should be thoroughly proofrolled with previously approved construction equipment having a minimum axle load of 10 tons (e.g. vibratory steel drum roller). The areas subject to proofrolling should be traversed by the equipment in two perpendicular (orthogonal) directions with overlapping passes of the vehicle under the observation of the geotechnical engineer or authorized representative. This procedure is intended to assist in identifying any localized yielding materials. In the event that unstable or "pumping" subgrade is identified by the proofrolling, those areas should be marked for repair prior to the placement of any subsequent structural fill or other construction materials. Methods of repair of unstable subgrade, such as undercutting or moisture conditioning or chemical stabilization, should be discussed with the geotechnical engineer to determine the appropriate procedure with regard to the existing conditions causing the instability. Test pits may be excavated to explore the shallow subsurface materials in the area of the instability to help in determined the cause of the observed unstable materials and to assist in the evaluation of the appropriate remedial action to stabilize the subgrade.

Engineered Fill Placement: Prior to placement of structural fill, representative bulk samples (about 50 pounds) of on-site and off-site borrow should be submitted to ECS for laboratory testing, which will include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications.

Materials satisfactory for use as structural fill should consist of inorganic soils classified as SM, SC, SW, SP, GW, GP, GM, and GC, or a combination of these group symbols, per ASTM D 2487. Natural fine-grained soils classified as clays or silts (CL, ML) should generally not be considered for use as engineered fill, but may be evaluated by the geotechnical engineer to determine their suitability at the contractor's request. The materials should be free of organic matter, debris, and should contain no particle sizes greater than 4 inches in the largest dimension. Open graded materials, such as gravels (GW and GP), which contain void space in their mass should not be used in structural fills unless properly encapsulated with filter fabric. Suitable structural fill material should have the index properties shown below.

Structural Fill Index Properties

Location with Respect to Final Grade	LL	PI	Max % Fines Passing # 200 Sieve
Fire Lane Area	35 max	9 max	20

Materials that should not be used as engineered fill include topsoil, organic materials (OH, OL), and high plasticity clays and silts (CH, MH). Such materials removed during grading operations should be either stockpiled for later use in landscape fills, or placed in approved on or off-site disposal areas.

In the area of the pervious fire lane area, compaction of at least 90% and no more than 95% should be achieved. In the area of the impervious fire lane area, compaction of at least 98% should be achieved. ECS should be called on to document that proper fill compaction has been achieved.

Fill Compaction Control: The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for the proposed construction area, at the time of fill placement. Grade controls should be maintained throughout the filling operations. All filling operations should be observed on a full-time basis by a qualified representative of the construction testing laboratory to determine that the minimum compaction requirements are being achieved. Field density testing of fills will be performed at the frequencies shown in the table below but not less than 1 test per lift.

Frequency of Compaction Tests in Fill Areas

Location	Frequency of Tests
Fire Lane Area	1 test per 10,000 sq. ft.

Compaction equipment suitable to the soil type being compacted should be used to compact the subgrades and fill materials. A vibratory steel drum roller should be used for compaction of coarse-grained soils (Sands) as well as for sealing compacted surfaces.

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 all 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.

At the end of each work day, all fill areas should be graded to facilitate drainage of any precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils.

Drying and compaction of wet soils is typically difficult during the cold, winter months. Accordingly, earthwork should be performed during the warmer, drier times of the year, if practical. Proper drainage should be maintained during the earthwork phases of construction to prevent ponding of water which has a tendency to degrade subgrade soils.

Where fill materials will be placed to widen existing embankment fills, or placed up against sloping ground, the soil subgrade should be scarified and the new fill benched or keyed into the existing material. Fill material should be placed in horizontal lifts. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 inches to 4 inches may be required to achieve specified degrees of compaction.

We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. We do not anticipate significant problems in controlling moisture within the fill during dry weather, but moisture control may be difficult during winter months or extended periods of rain. The control of moisture content of higher plasticity soils is difficult when these soils become wet. Further, such soils are easily degraded by construction traffic when the moisture content is elevated.

Closure: ECS has prepared this report of findings, evaluations, and recommendations to guide geotechnical-related design and construction aspects of the project. The description of the proposed project is based on information provided to ECS by McGill and Associates. If any of this information is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately so that we can review the report in light of the changes and provide additional or alternate recommendations as may be required to reflect the proposed construction.

It has been our pleasure to be of service to Brunswick County Schools 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 the assumptions of subsurface conditions made 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,

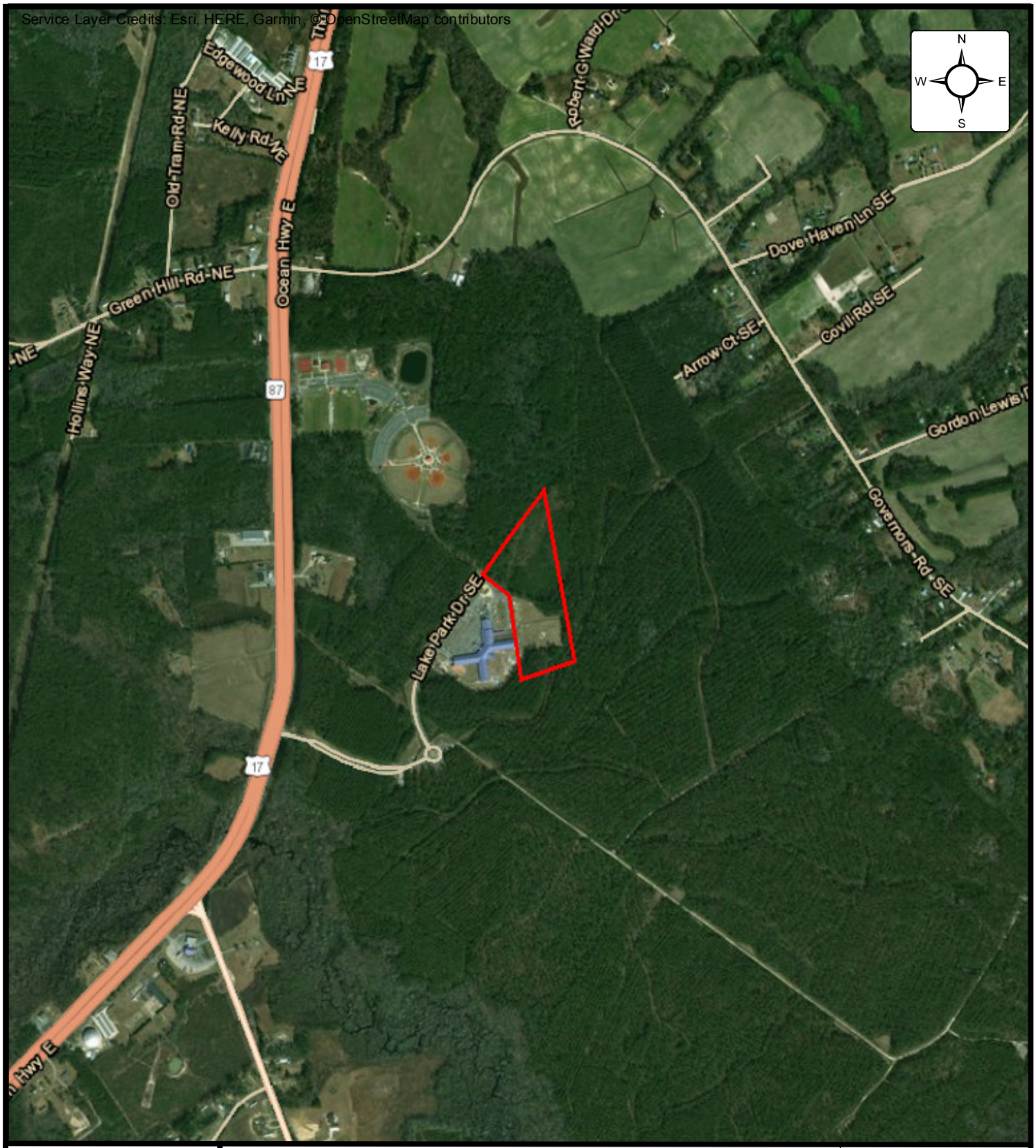
ECS Southeast, LLP



Mike Ellis, E.I.
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Principal Engineer
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Attachments:
Site Location Plan
Exploration Location Plan
Kessler DCP Test Results
Reference Notes for USCS Classification
Hand Auger Boring logs
SHWT Report
ASFE Document

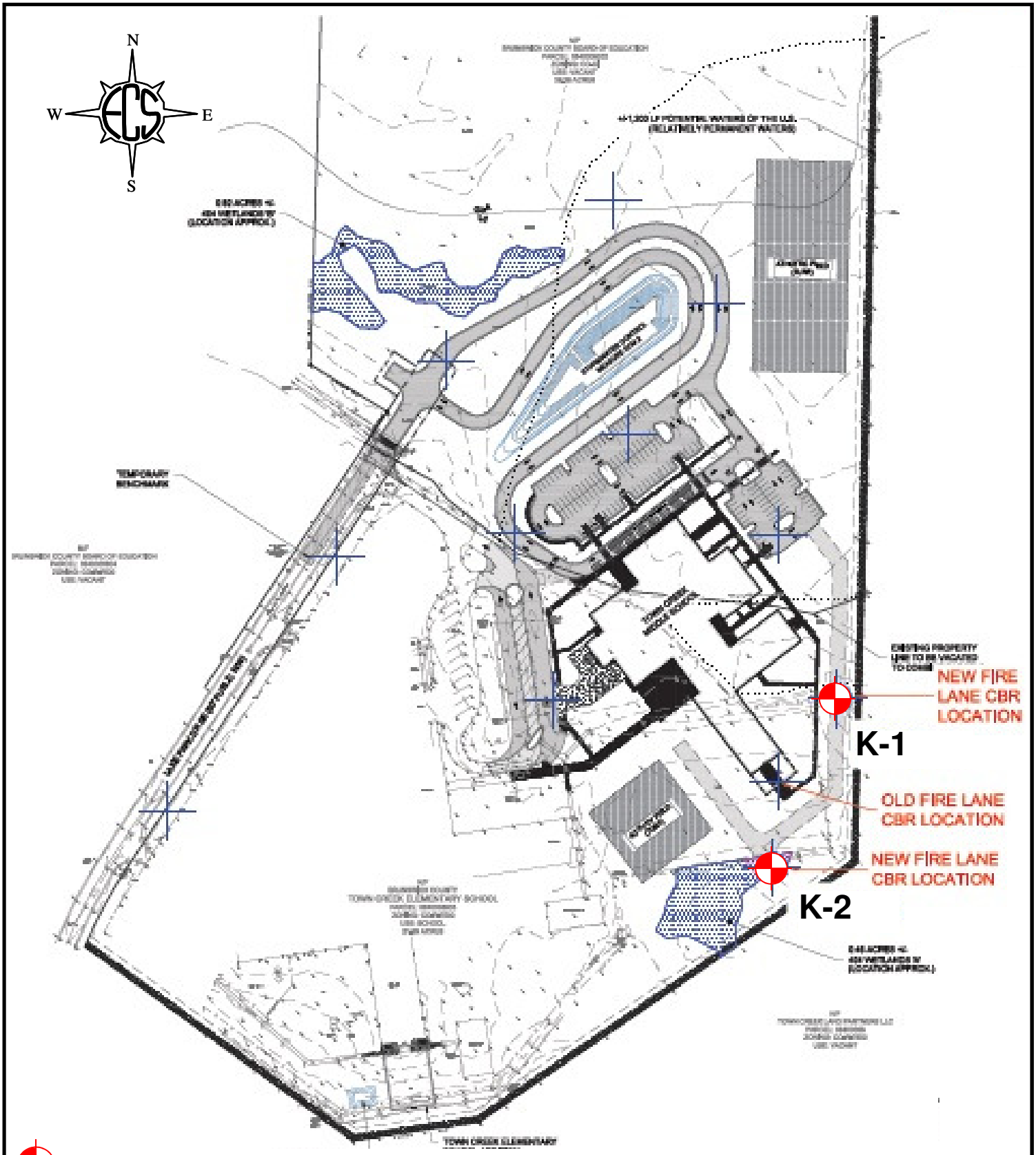


SITE LOCATION DIAGRAM

TCMS - FIRE LANE

WINNABOW, NORTH CAROLINA

ENGINEER	WEG
SCALE	NTS
PROJECT NO.	22:26426
SHEET	1 OF 2
DATE	3/6/2018



DENOTES APPROXIMATE LOCATION OF HAND AUGER BORING WITH KESSLER DCP TEST

EXPLORATION LOCATION DIAGRAM

TCMS – Fire Lane

Winnabow, North Carolina

REFERENCE	McGill Associates
ENGINEER	WEG
DRAFTING	FMW
SCALE	NTS
SHEET	2 OF 2
PROJECT NO.	22.26426
DATE	3/5/2018

DCP TEST DATA

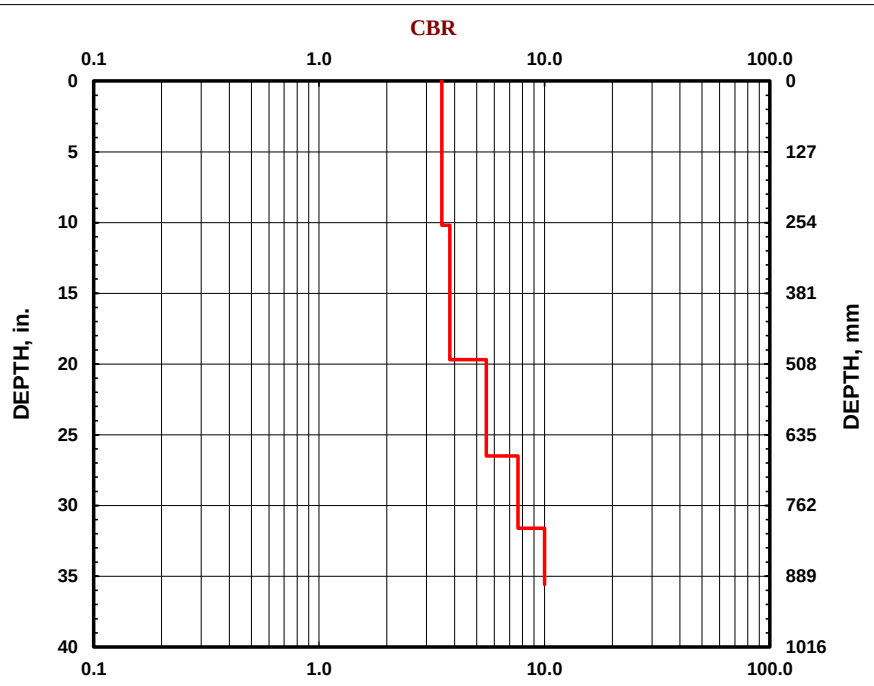
Project: *TCMS - Fire Lane* **Date:** 5-Mar-18

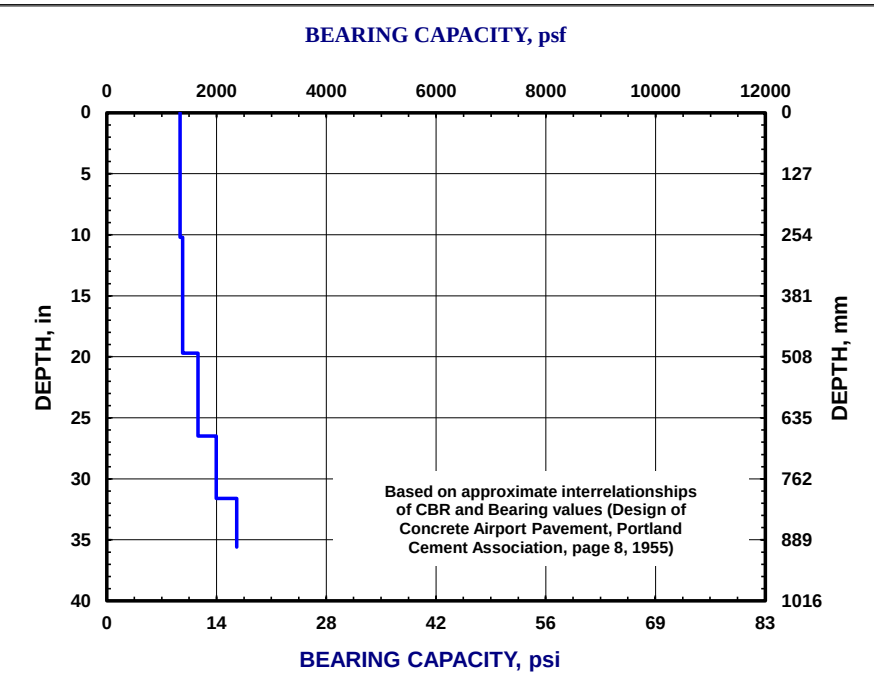
Location: K-1 **Soil Type(s):** SAND (SC, SM) and CLAY (CL)

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	259	1
5	500	1
5	673	1
5	803	1
5	904	1





DCP TEST DATA

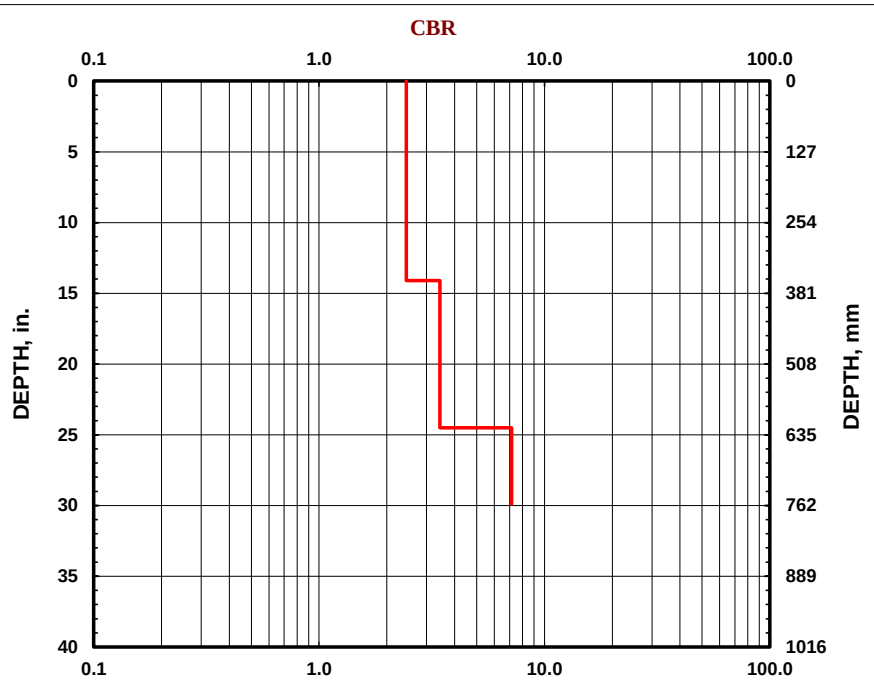
Project: *TCMS - Fire Lane* **Date:** 5-Mar-18

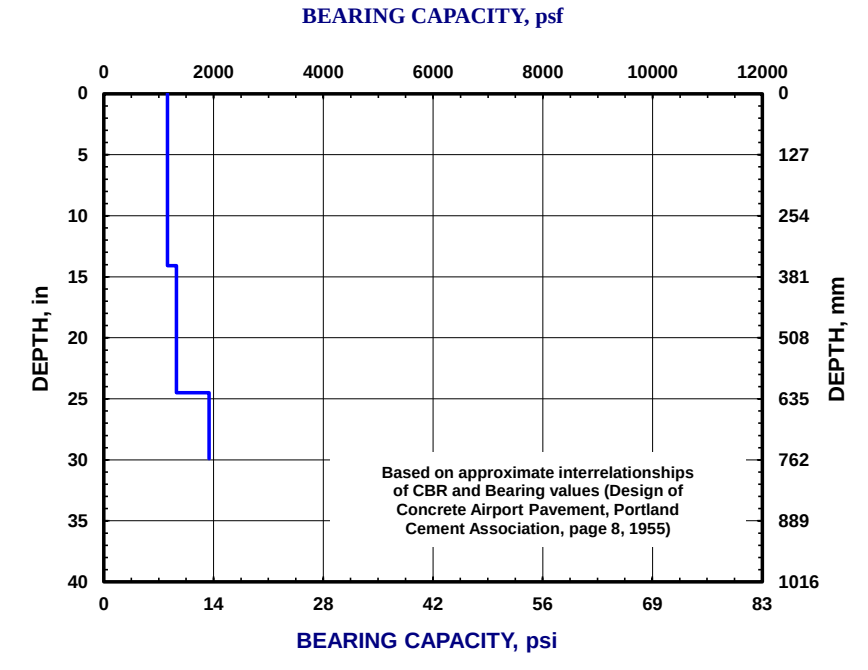
Location: K-2 **Soil Type(s):** SAND (SM, SC)

Hammer
- ○ 10.1 lbs.
- ◉ 17.6 lbs.
- ○ Both hammers used

Soil Type
- ○ CH
- ○ CL
- ◉ All other soils

No. of Blows	Cumulative Penetration (mm)	Type of Hammer
0	0	1
5	358	1
5	622	1
5	759	1

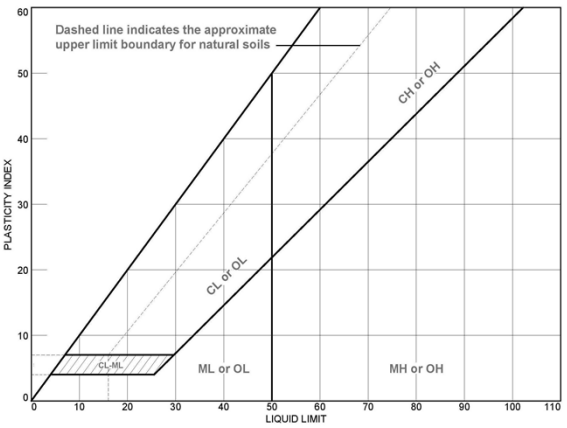




Unified Soil Classification System
(ASTM Designation D-2487)

Major Division			Group Symbol	Typical Names	Classification on basis of percentage of fines	Classification Criteria
Coarse-grained soils More than 50% retained on No. 200 sieve	Gravels More than 50% of coarse fraction retained on No. 4 sieve		GW	Well-graded gravels and gravel-sand mixtures, little or no fines	GW, GP, SW, SP GM, GC, SM, SC Borderline classification requiring use of dual symbol	$C_u = D_{60}/D_{10}$ Greater than 4 $C_z = (D_{30})^2/(D_{10}xD_{60})$ Between 1 and 3
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines		Not meeting both criteria for GW
			GM	Silty gravels, gravel-sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7
	Sands More than 50% of coarse fraction passes No. 4 sieve		SW	Well-graded sands and gravelly sands, little or no fines	Less than 5% Pass No. 200 sieve More than 12% Pass No. 200 sieve 5% to 12% Pass No. 200 sieve	$C_u = D_{60}/D_{10}$ Greater than 6 $C_z = (D_{30})^2/(D_{10}xD_{60})$ Between 1 and 3
			SP	Poorly graded sands and gravelly sands, little or no fines		Not meeting both criteria for SW
			SM	Silty sands, sand-silt mixtures		Atterberg limits plot below "A" line or plasticity index less than 4
			SC	Clayey sands, sand-clay mixtures		Atterberg limits plot above "A" line and plasticity index greater than 7
Fine-grained soils 50% or more passing No. 200 sieve	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts		
			CH	Inorganic clays of high plasticitiy, fat clays		
			OH	Organic clays of medium to high plasticity		
Highly organic soils			Pt	Peat, muck and other highly organic soils		Fibrous organic matter; will char, burn, or glow

Note: U-line represents approximate upper limit of LL and PI combinations for natural soils (empirically determined). ASTM-D2487.



Plasticity chart for the classification of fine-grained soils.
Tests made on fraction finer than No. 40 sieve

UNIFIED SOIL CLASSIFICATION SYSTEM

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:26426	K-1	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
TCMS - Fire Lane	

SITE LOCATION

6330 Lake Park Dr SE, Winnabow, Brunswick County, North Carolina

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% WATER CONTENT% LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0							
1							
2							
3							
4							
5							
6							

Topsoil/Rootmat Depth [6"]

(SM) SILTY FINE SAND WITH CLAYEY LAYERS, dark gray, moist

(CL) SANDY CLAY, orange to gray, moist to saturated

END OF BORING @ 4.0'

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL 1.7' WS ☐ WD ☐	BORING STARTED 3/5/18	CAVE IN DEPTH
WL(SHW) WL(ACR)	BORING COMPLETED 3/5/18	HAMMER TYPE
WL	RIG FOREMAN	DRILLING METHOD Hand Auger

CLIENT	Job #:	BORING #	SHEET
Brunswick County Schools	22:26426	K-2	1 OF 1

PROJECT NAME	ARCHITECT-ENGINEER
TCMS - Fire Lane	

SITE LOCATION

6330 Lake Park Dr SE, Winnabow, Brunswick County, North Carolina

NORTHING	EASTING	STATION

CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% | WATER CONTENT% | LIQUID LIMIT%

STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING | LOSS OF CIRCULATION

SURFACE ELEVATION

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil/Rootmat Depth [6']			
					(SM) SILTY FINE SAND WITH CLAYEY LAYERS, dark gray, moist to saturated	▽		
1								
2								
					(SC) CLAYEY FINE SAND, orange to gray, saturated			
3								
4					END OF BORING @ 4.0'			
5								
6								

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

▽ WL 1.7' WS ☐ WD ☐	BORING STARTED 3/5/18	CAVE IN DEPTH
▽ WL(SHW) ▼ WL(ACR)	BORING COMPLETED 3/5/18	HAMMER TYPE
▽ WL	RIG FOREMAN	DRILLING METHOD Hand Auger

ECS SOUTHEAST, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities
NC Registered Engineering Firm F-1078
NC Registered Geologists Firm C-406
SC Registered Engineering Firm 3239

March 8, 2018

Mr. Craig Eckert
Brunswick County Schools
35 Referendum Drive
Bolivia, North Carolina 28422

Reference: Report of Seasonal High Water Table Estimation
Town Creek Schools
Winnabow, Brunswick County, North Carolina
ECS Project No. 49.6405

Dear Mr. Eckert:

ECS Southeast, LLP (ECS) recently conducted a seasonal high water table (SHWT) estimation within the proposed stormwater control measure (SCM) area(s) at 6330 Lake Park Drive in Winnabow, Brunswick County, North Carolina. This letter, with attachments, is the report of our testing.

Field Testing

On March 5, 2018, ECS conducted an exploration of the subsurface soil and groundwater conditions at two requested locations shown on the attached Boring Location Plan (Figure 1). ECS located the boring locations using GPS equipment. The purpose of this exploration was to obtain subsurface information of the in situ soils for the SCM area(s). ECS explored the subsurface soil and groundwater conditions by advancing one hand auger boring into the existing ground surface at each of the requested boring locations. ECS visually classified the subsurface soils and obtained representative samples of each soil type encountered. ECS also recorded the SHWT and groundwater elevation observed at the time of the hand auger borings. The attached Infiltration Testing Form provides a summary of the subsurface conditions encountered at the hand auger boring locations.

The SHWT and groundwater elevation was estimated at the boring locations below the existing grade elevation. A summary of the findings are as follows:

Location	SHWT	Groundwater
B-1	10 inches	20 inches
B-2	6 inches	20 inches

SHWT may vary within the proposed site due to changes in elevation and subsurface conditions. ECS observed wetland flagging within the vicinity of B-2. ECS anticipates that the SHWT be at the surface elevation within the wetland areas located in the SCM system footprint.

Closure

ECS's analysis of the site has been based on our understanding of the site, the project information provided to us, and the data obtained during our exploration. If the project information provided to us is changed, please contact us so that our recommendations can be reviewed and appropriate revisions provided, if necessary. The discovery of any site or subsurface conditions during construction which deviate from the data outlined in this exploration should be reported to us for our review, analysis and revision of our recommendations, if necessary. The assessment of site environmental conditions for the presence of pollutants in the soil and groundwater of the site is beyond the scope of this geotechnical exploration.

ECS appreciates the opportunity to provide our services to you on this project. If you have any questions concerning this report or this project, please contact us.

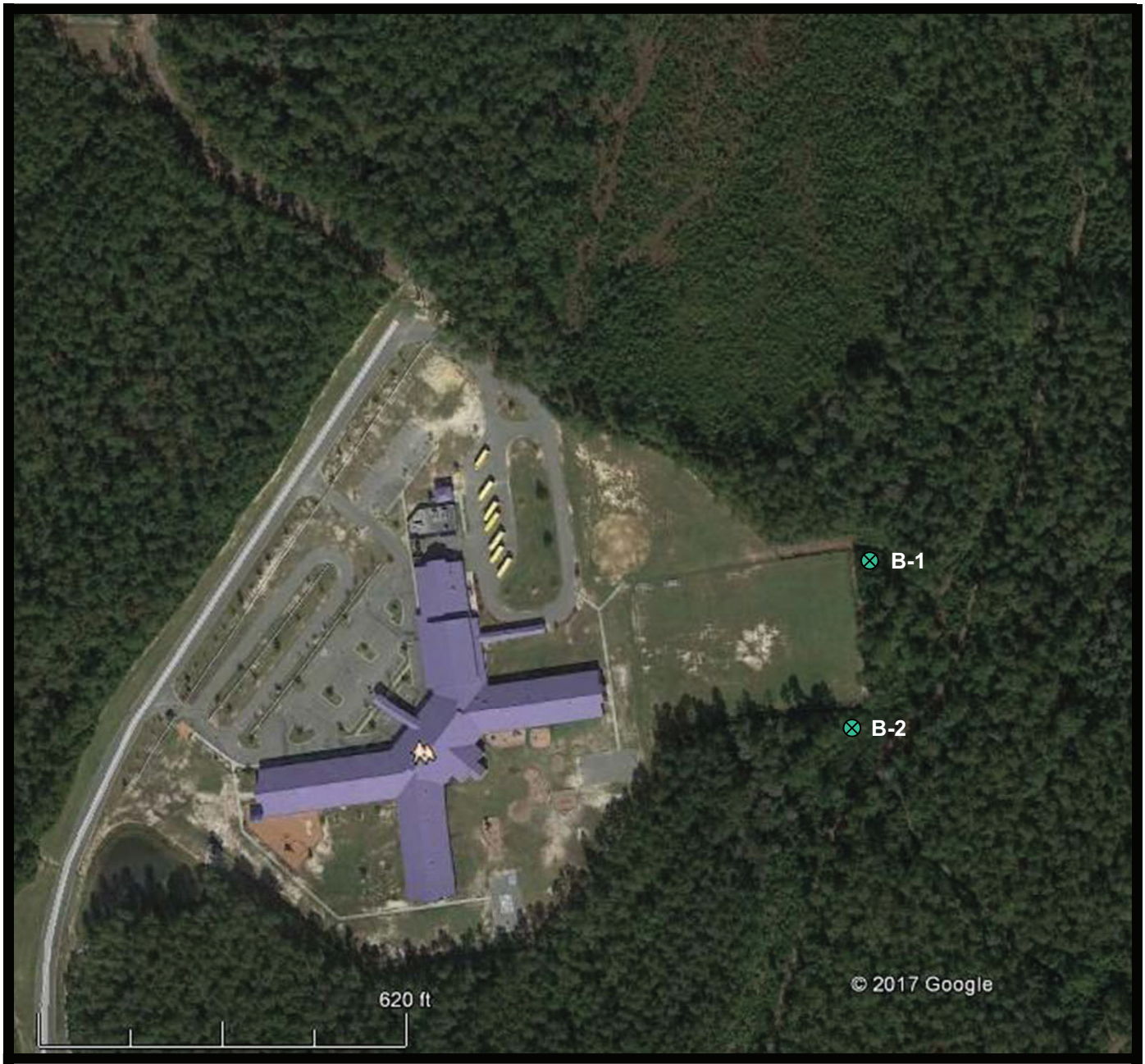
Respectfully,

ECS SOUTHEAST, LLP

K. Brooks Wall
Project Manager
bwall@ecslimited.com
910-686-9114

W. Brandon Fulton, PSC, PWS, LSS
Environmental Department Manager
bfulton@ecslimited.com
704-525-5152

Attachments: Figure 1 - Boring Location Plan
Boring Log Form
ASFE Document



⊗ **APPROXIMATE BORING LOCATIONS**

SCALE SHOWN ABOVE

N
W E
S

Town Creek Schools
Winnabow, Brunswick County,
North Carolina

ECS Project # 49.6405
March 5, 2018
KBW

Figure 1– Boring Location Plan

Provided by: Google Earth

Infiltration Testing Form
Town Creek Schools
Winnabow, Brunswick County, North Carolina
ECS Project No. 49.6405
March 5th, 2018

Location	Depth	USCS	Soil Description
B-1	0-12”	SC	Orange/gray silty clayey SAND
	12”-48”	CL	Gray sandy CLAY

Seasonal High Water Table was estimated to be at 10 inches below the existing grade elevation.
Groundwater was encountered at 20 inches below the existing grade elevation.

Location	Depth	USCS	Soil Description
B-2	0-24”	SM	Dark gray silty/clayey SAND
	24”-48”	SC	Orange/gray clayey SAND

Seasonal High Water Table was estimated to be at 6 inches below the existing grade elevation.
Groundwater was encountered at 20 inches below the existing grade elevation.

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes

The following information is provided to help you manage your risks.

Geotechnical 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 civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from alight industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- 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. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ-sometimes significantly from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of 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 equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in-this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer For Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone:' 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

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IIGER06045.0M

Liquefaction Potential Evaluation
Town Creek Middle School
Winnabow, North Carolina

S&ME Project No. 1306-18-003

PREPARED FOR:

Brunswick County Schools
35 Referendum Drive
Bolivia, North Carolina 28422

PREPARED BY:

S&ME, Inc.
3006 Hall Waters Dr, Suite 100
Wilmington, NC 28405

February 5, 2018

February 5, 2018

Brunswick County Schools
35 Referendum Drive
Bolivia, North Carolina 28422

Attention: Mr. Jack Doyle

Reference: **Liquefaction Potential Evaluation**
Town Creek Middle School
Winnabow, North Carolina
S&ME Project No. 1306-18-003
NC PE Firm License No. F-0176

Dear Mr. Doyle:

S&ME, Inc. (S&ME) is pleased to present this liquefaction evaluation for Town Creek Middle School located in Winnabow, North Carolina. Our services were provided in general accordance with S&ME Proposal No. 13-1800059 dated January 30, 2018. This report presents the findings of our additional subsurface exploration along with geotechnical evaluation of the site soil's liquefaction potential and estimates of settlement resulting from the design seismic design event.

S&ME appreciates having the opportunity to be of service to you on this project by providing a review of a portion of the geotechnical evaluation performed for this project. We hope to continue our involvement in this project during the continued design development phase and upcoming construction phase. If you have any questions or comments after reviewing this report, please let us know so we can address them.

Sincerely,

Aly Yetman, P.E.
Project Engineer

NORTH CAROLINA PROFESSIONAL SEAL 022540 ENGINEER KEITH C. BROWN

Keith Brown
Feb 5 2018 2:35 PM

Keith C. Brown, P.E.
Vice President
NC Registration No. 022540

Senior Reviewed by Aaron Goldberg, P.E., D.GE

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Appendix

Appendix I – Figures
Appendix II – CPT Sounding Logs
Appendix III – Liquefaction Analysis Reports
Appendix IV – Shear Wave Velocity Tables

1.0 Project Information

S&ME was provided with a pdf copy of an ECS report dated December 20, 2017 which included data from 20 CPT soundings from within the Middle School Building footprint, as shown on our Figure 1. S&ME was not provided a copy of the electronic files associated with the CPT testing nor do we have GPS coordinates of the performed soundings. Brunswick County Schools (BCS) asked S&ME to evaluate the presence or absence of liquefiable soils on the site.

Project information is based on email correspondence with Mr. Jack Doyle of BCS and a team teleconference on January 29, 2018 that included representatives from BCS, WM Jordan, KSQ Design and S&ME. The site has been partially logged, is partially an open field and the remainder heavily wooded. Based on Google Earth, site elevations range from 27 to 32 feet.

2.0 Geology

Based on a review of Hydrogeology and Ground-Water Quality of Brunswick County, North Carolina by Harden, Fine and Spruill on behalf of the U.S. Geological Survey, the site is underlain by surficial deposits of the Quarternary and possible Tertiary deposits including the River Bend, Castle Hayne and Beaufort Formations. Underlying the Quarternary and Tertiary deposits, the Peedee Formation, member of the Upper Cretaceous series and Cretaceous System is encountered.

Well BR-182(ground surface elevation 32 feet), Table 1, pg 79 is located approximately 2 miles south of Town Creek Middle School. The top of the Peedee Formation was encountered at elevation 14 feet. Based on similar ground surface elevations, S&ME would anticipate encountering the Peedee formation approximately 15 to 20 feet below the existing ground surface. The top of the Peedee tends to slope down from the southeast at a rate of 5-8 ft/mile. Sediments of the Peedee Formation consist of fine to medium grained sand, interbedded with gray to black clay and silt deposited under marine conditions. Sand beds are gray to greenish-gray in color. Shells are common throughout the formation. Thin beds of calcareous sandstone and impure limestone are interlayered in the sand beds.

3.0 Field Exploration

The field exploration consisted of performing 6 additional cone penetration test (CPT) soundings. The soundings were located in the field by Owens Surveying. Figure 1 presents the *Sounding Location Plan* and shows the approximate sounding locations.

3.1 Cone Penetration Test Soundings

Six CPT soundings (C-1 through C-6) were performed within the proposed Middle School Building. The CPT soundings were advanced to refusal at depths of 32.7 to 33.6 ft below existing grades. All CPT soundings were performed using a push frame mounted on a track-mounted carrier by hydraulically pushing a cylindrical steel cone into the ground in general accordance with ASTM D5778. The cone that was used has a tip area of 10 sq-cm and a sleeve friction area of 150 sq-cm. The piezometer consists of a 5 mm wide plastic porous element located immediately behind the cone tip. As the cone was advanced, electronic sensors continuously

recorded resistance at the cone tip and along the cone side (sleeve) and pore water pressures behind the tip. Water levels were measured in completed soundings. S&ME performed seismic shear wave velocity testing on 3 foot intervals in soundings C-1 and C-3.

CPT sounding logs are contained in the Appendix.

4.0 Subsurface Conditions

The subsurface profile was characterized from our interpretation of the CPT soundings. Cone tip and sleeve resistances along with pore water pressure measurements are used to characterize the subsurface soils by correlating to engineering properties and assigning the materials to a Soil Behavior Type (SBT). Note, that unlike the Unified Soil Classification System (USCS) which bases its classification on grain size distribution and plasticity, the SBTs are directly representative of a soil's behavior such as resistance to penetration, response to undrained loading, etc. The subsurface stratigraphy is in turn defined by the SBT.

In general the subsurface profile in the Middle School consists of loose sands with intermittent layers of soft silt and clay. All soundings refused at depths of 32 to 33 feet below the existing ground surface, in what is assumed to be a cemented sand layer or limestone, which is common within the Peedee formation. For more detailed soil descriptions and stratifications at a particular boring location, the respective boring and sounding logs should be reviewed.

Water levels were measured in completed soundings at depths of about 3 to 4 ft below the existing ground surface.

5.0 Liquefaction Evaluation

5.1 Seismic Site Class

Seismic site classification is based on the top 100 ft of a site's subsurface profile. A shear wave velocity (Vs) profile was developed based on the seismic cone data from C-1 and C-3. Based on the measured data, an average shear wave velocity in the upper 100 ft of the subsurface materials of 1,043 to 1,095 ft/sec was computed. In accordance with Section 1613 of the *2012 North Carolina Building Code*, the site is designated as **Seismic Site Class D**. The presence of liquefiable soils described below does not pass the threshold to classify the site as a site class F.

5.2 Liquefaction Triggering Evaluation

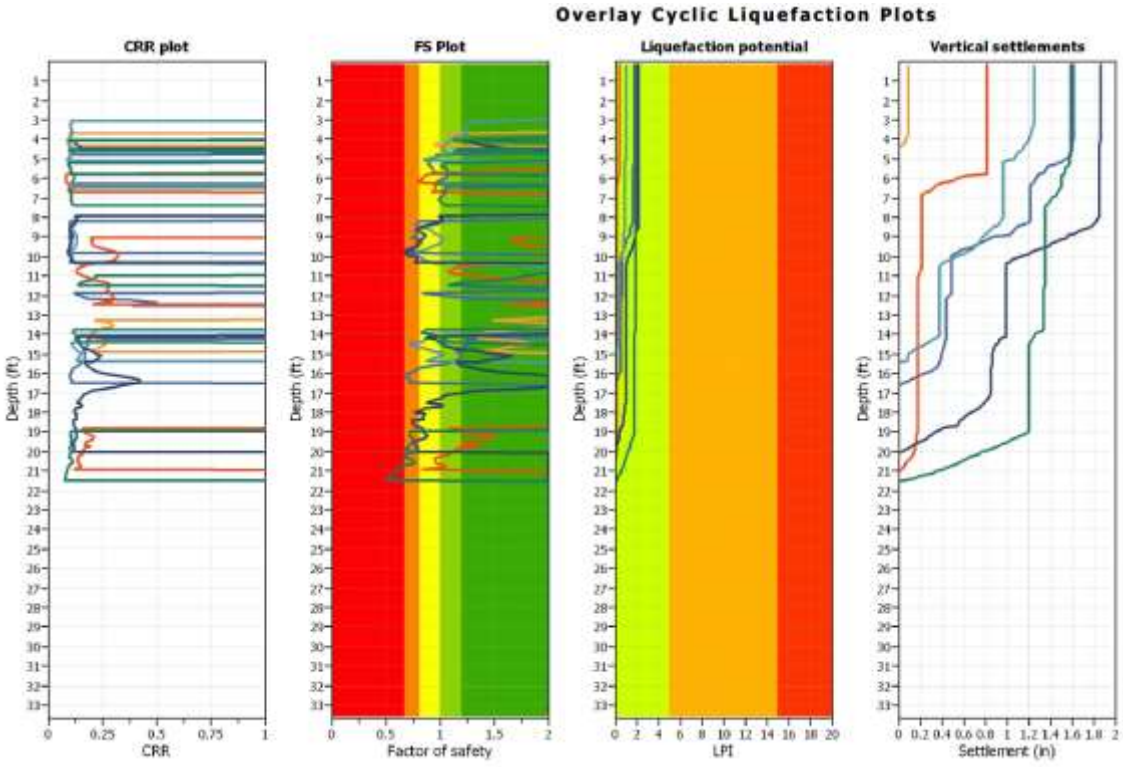
We performed a seismic liquefaction triggering evaluation using the methods presented by Youd et. al. (2001) and Boulanger and Idriss (2014) based on the design earthquake (M=7.3). The design earthquake has a 2 percent probability of exceedance in a 50 year period. This is equivalent to an earthquake that has the likelihood of occurring once every 2,475 years. Using the 2012 North Carolina Building Code (which is based on the 2009 International Building Code), the design seismic event has a peak ground acceleration (pga) of 0.13 g at this site. This value was calculated using Seismic Site Class D, calculating the five-percent damped

spectral response acceleration at short periods, SDS, using the USGS website tool for U.S. Seismic Design Maps, and dividing SDS by 2.5 per Section 1803.5.12 (2) of the 2012 North Carolina Building Code.

To help evaluate the consequences of liquefaction, the Liquefaction Potential Index (LPI) was computed. The LPI is an empirical tool used to evaluate the site liquefaction hazard and the potential for liquefaction-induced foundation damages. The LPI considers the factor of safety against liquefaction, the depth to the liquefiable soils, and the thickness of the liquefiable soils to compute an index that ranges from 0 to 100. An LPI of 0 means there is no risk of liquefaction; an LPI of 100 means the entire profile is expected to liquefy. The level of risk is generally defined as:

- LPI < 5 – surface manifestation and liquefaction-induced damage not expected.
- 5 ≤ LPI ≤ 15 – moderate liquefaction with some surface manifestation possible.
- LPI > 15 – severe liquefaction and foundation damage is likely.

The LPI for this site is less than 2.5, which indicates the liquefaction risk is low and foundation damage is not expected. Our analysis indicates approximately 1/10 in. to 1¾ in. of free-field liquefaction-induced settlements are possible. S&ME would anticipate about 1 inch of differential settlement might occur across relatively short distances. Our liquefaction evaluation for all six CPT soundings is summarized in the following figure, and individual results are included in the Appendix.



6.0 Professional Opinion and Commentary

The low risk of foundation damage following the design seismic event discussed above should be understood quantitatively as the potential for about 1 inch of differential settlement. Your decision for implementing ground improvements, strengthening foundations, or strengthening the structure for the design seismic event should be based upon this differential settlement.

7.0 Limitations of Report

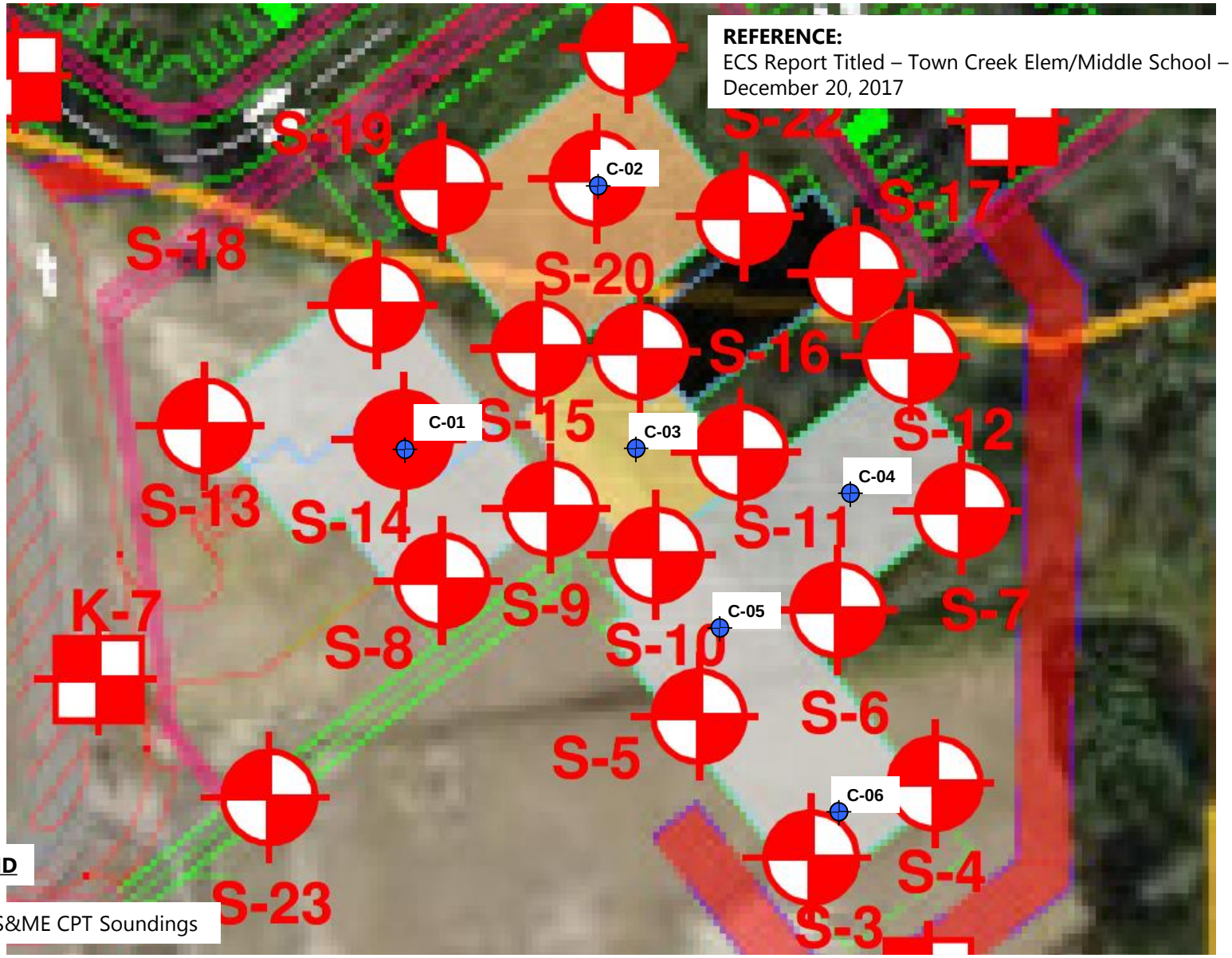
This report has been prepared in accordance with generally accepted geotechnical engineering practice for specific application to this project. The conclusions and recommendations contained in this report are based upon applicable standards of our practice in this geographic area at the time this report was prepared. No other representation or warranty either express or implied, is made.

We relied on project information given to us and the ECS Geotechnical Report dated December 20, 2017 to develop our conclusions and recommendations. If project information described in this report is not accurate, or if it changes during project development, we should be notified of the changes so that we can modify our recommendations based on this additional information if necessary.

Our conclusions and recommendations are based on limited data from a field exploration program. Subsurface conditions can vary widely between explored areas. Some variations may not become evident until construction. If conditions are encountered which appear different than those described in our report, we should be notified. This report should not be construed to represent subsurface conditions for the entire site.

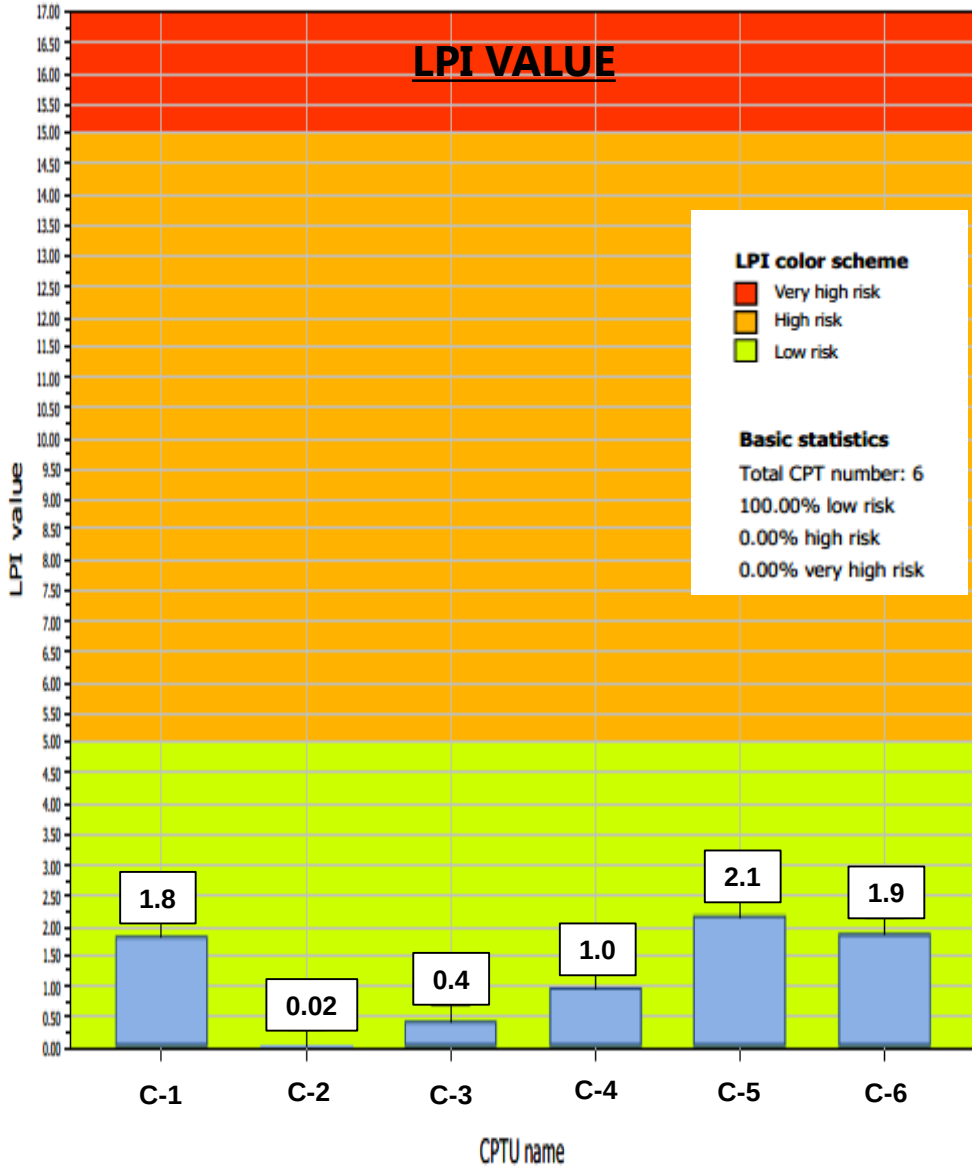
S&ME should be retained to review the final plans and specifications to confirm that earthwork, foundation, and other recommendations are properly interpreted and implemented. The recommendations in this report are contingent on S&ME's review of final plans and specifications followed by our observation and monitoring of earthwork and foundation construction activities.

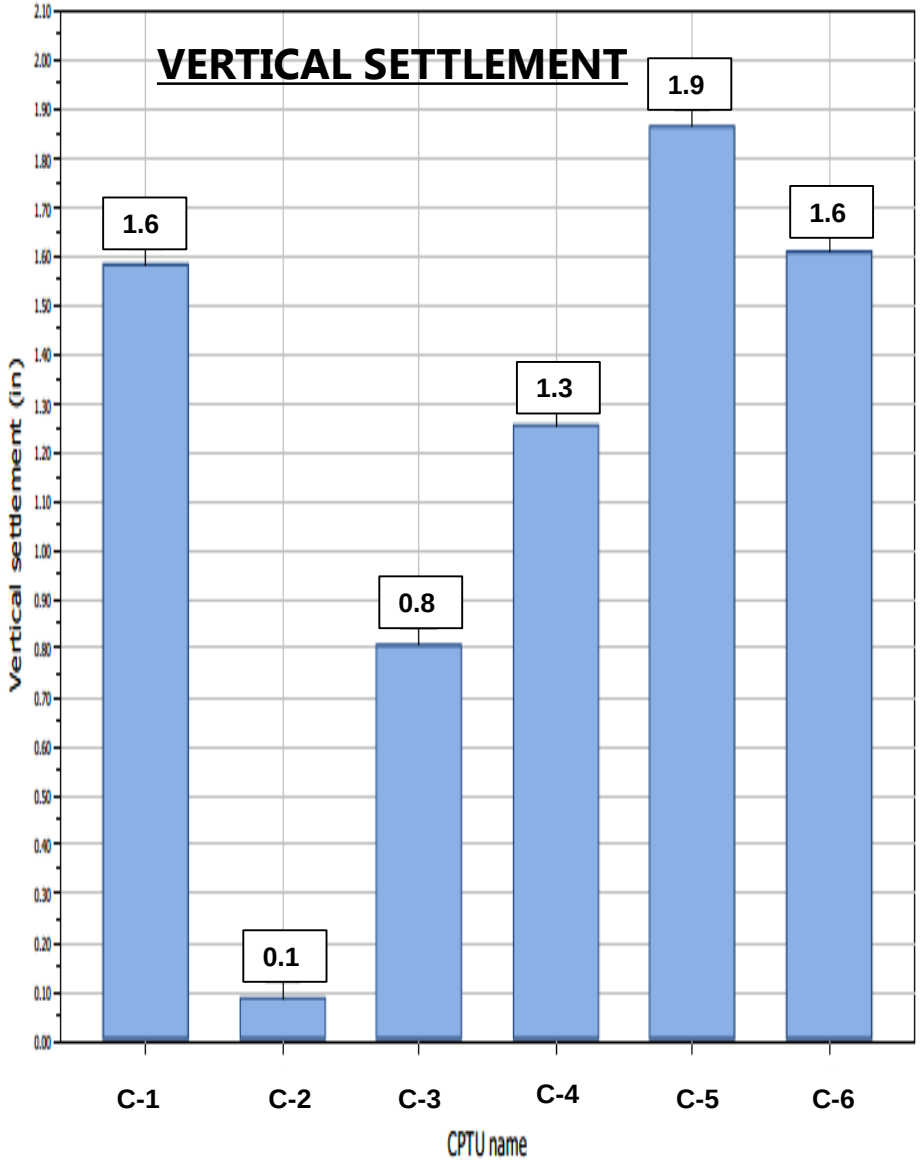
Appendix I – Figures



SOUNDING LOCATION PLAN
TOWN CREEK ELEMENTARY AND MIDDLE SCHOOL
WINNABOW, NORTH CAROLINA

SCALE:	FIGURE NO.
NOT TO SCALE	1
DATE:	
2/03/2018	
PROJECT NUMBER	
1306-18-003	





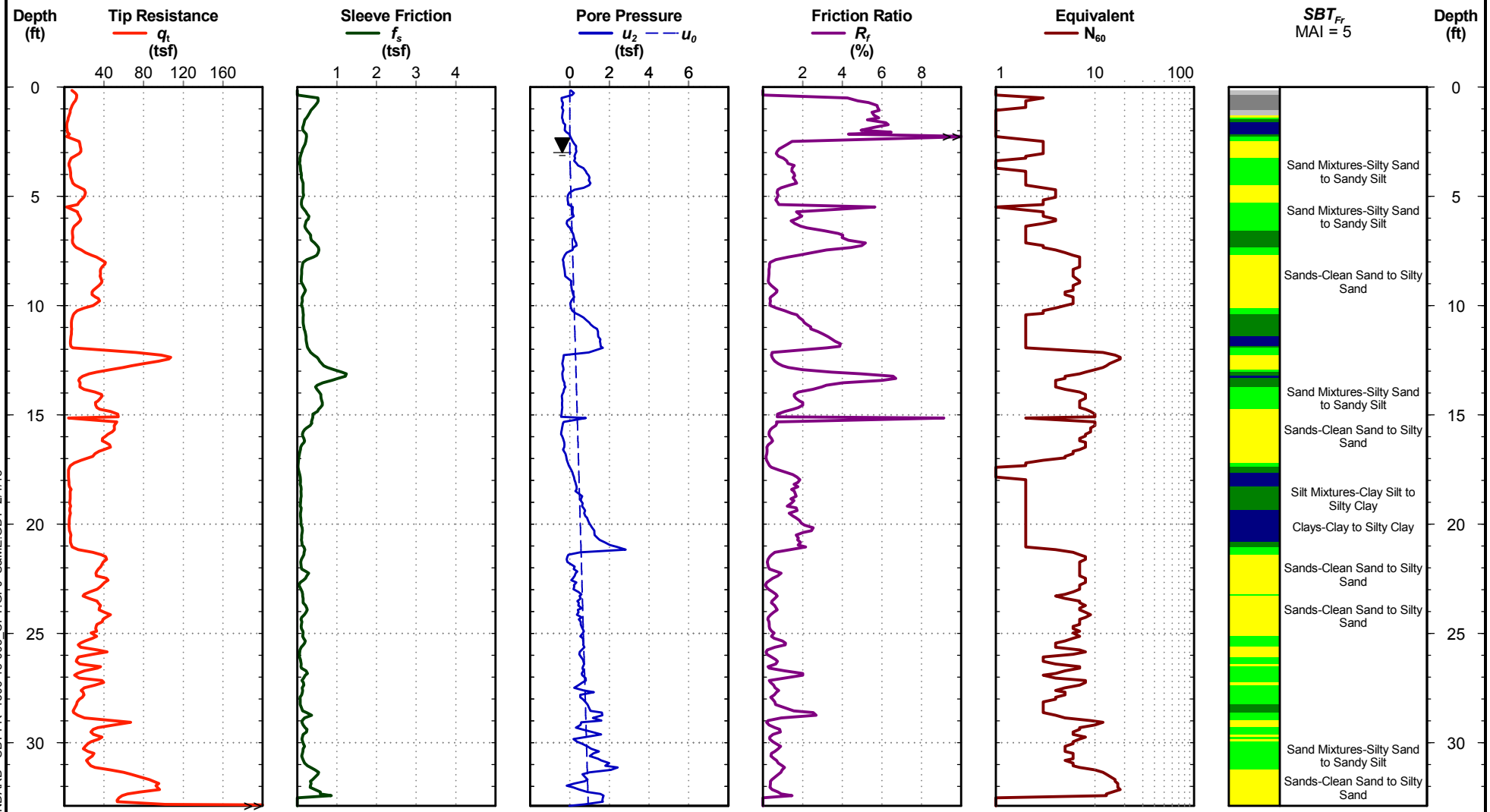
	LPI VALUE & VERTICAL SETTLEMENT DUE TO LIQUEFACTION	SCALE: NOT TO SCALE	FIGURE NO. 2
	ADDITIONAL CPT SOUNDINGS TOWN CREEK ELEMENTARY AND MIDDLE SCHOOL WINNABOW, NORTH CAROLINA	DATE: 2/03/2018 PROJECT NUMBER 1306-18-003	

Appendix II – CPT Sounding Logs

Sounding ID: C-1

Town Creek Elem/Middle
Winnabow, North Carolina
S&ME Project No: 1306-18-003

Date:	Jan. 31, 2018	**Total Depth:**	32.9 ft
Estimated Water Depth:	3 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Gyrotrack/A. Feix	**Cone Size:**	1.75



Cone Penetration Test

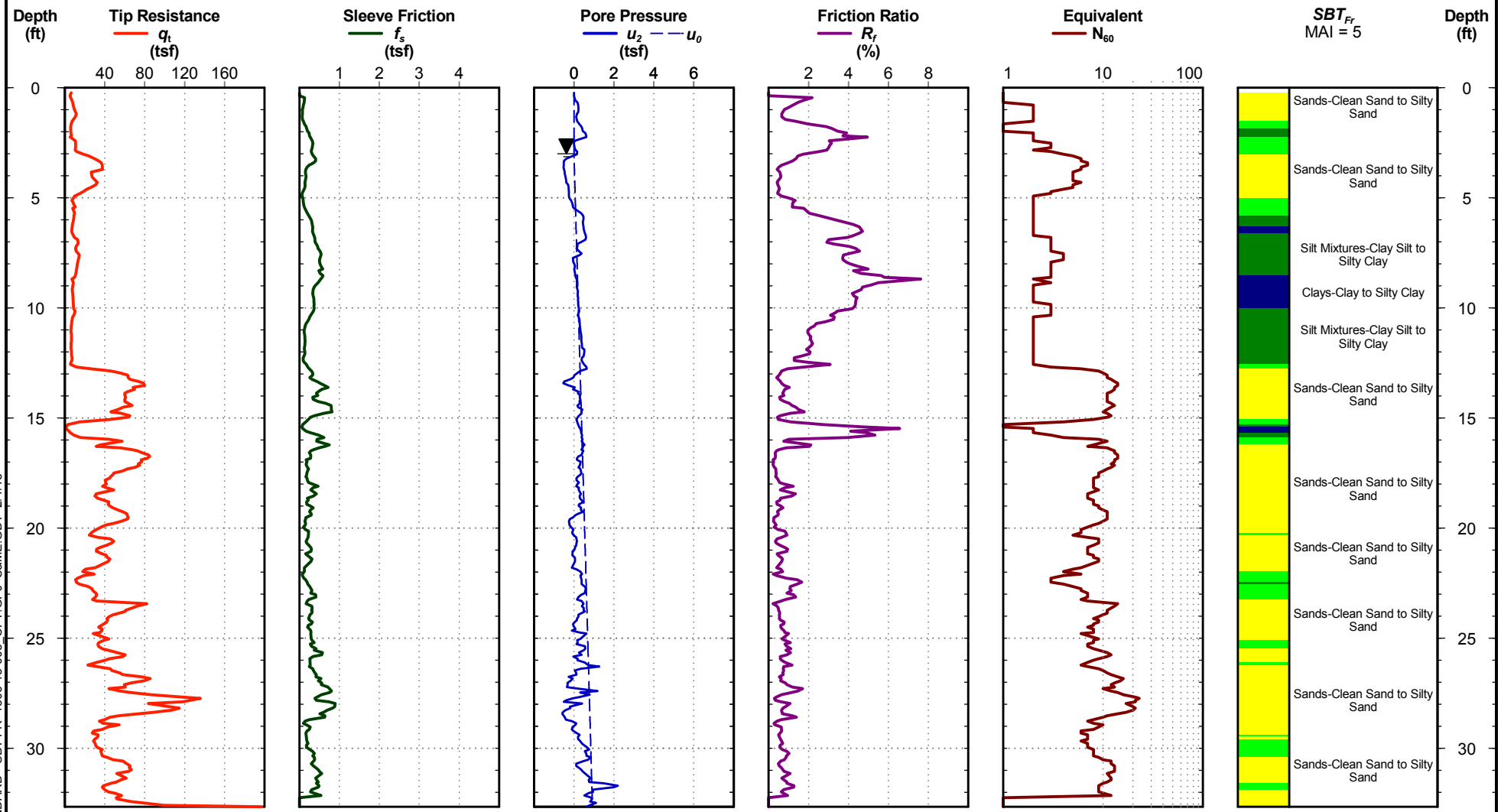
CPT REPORT - STANDARD - SBT FR 1306-18-003_CPT.GPJ S&ME.GDT 2/1/18

Electronic Filename: C-1(065)_PD.DAT

Sounding ID: C-2

Town Creek Elem/Middle
Winnabow, North Carolina
S&ME Project No: 1306-18-003

Date:	Jan. 31, 2018	**Total Depth:**	32.7 ft
Estimated Water Depth:	3 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Gyrotrack/A. Feix	**Cone Size:**	1.75



Cone Penetration Test

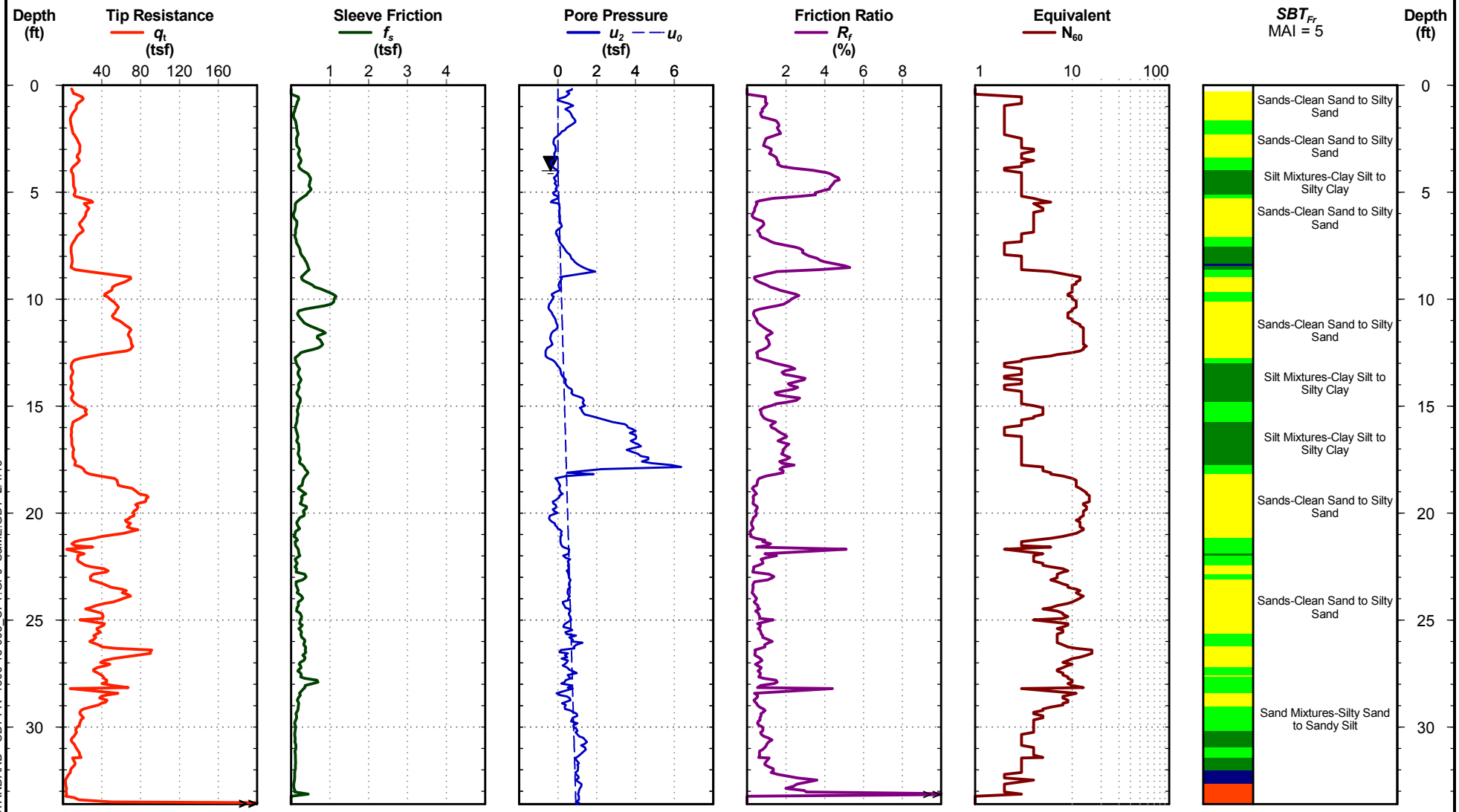
CPT REPORT - STANDARD - SBT FR 1306-18-003_CPT.GPJ S&ME.GDT 2/1/18

Electronic Filename: C-2(066)_PD.DAT

Sounding ID: C-3

Town Creek Elem/Middle
Winnabow, North Carolina
S&ME Project No: 1306-18-003

Date:	Jan. 31, 2018	**Total Depth:**	33.6 ft
Estimated Water Depth:	4 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Gyrotrack/A. Feix	**Cone Size:**	1.75



Cone Penetration Test

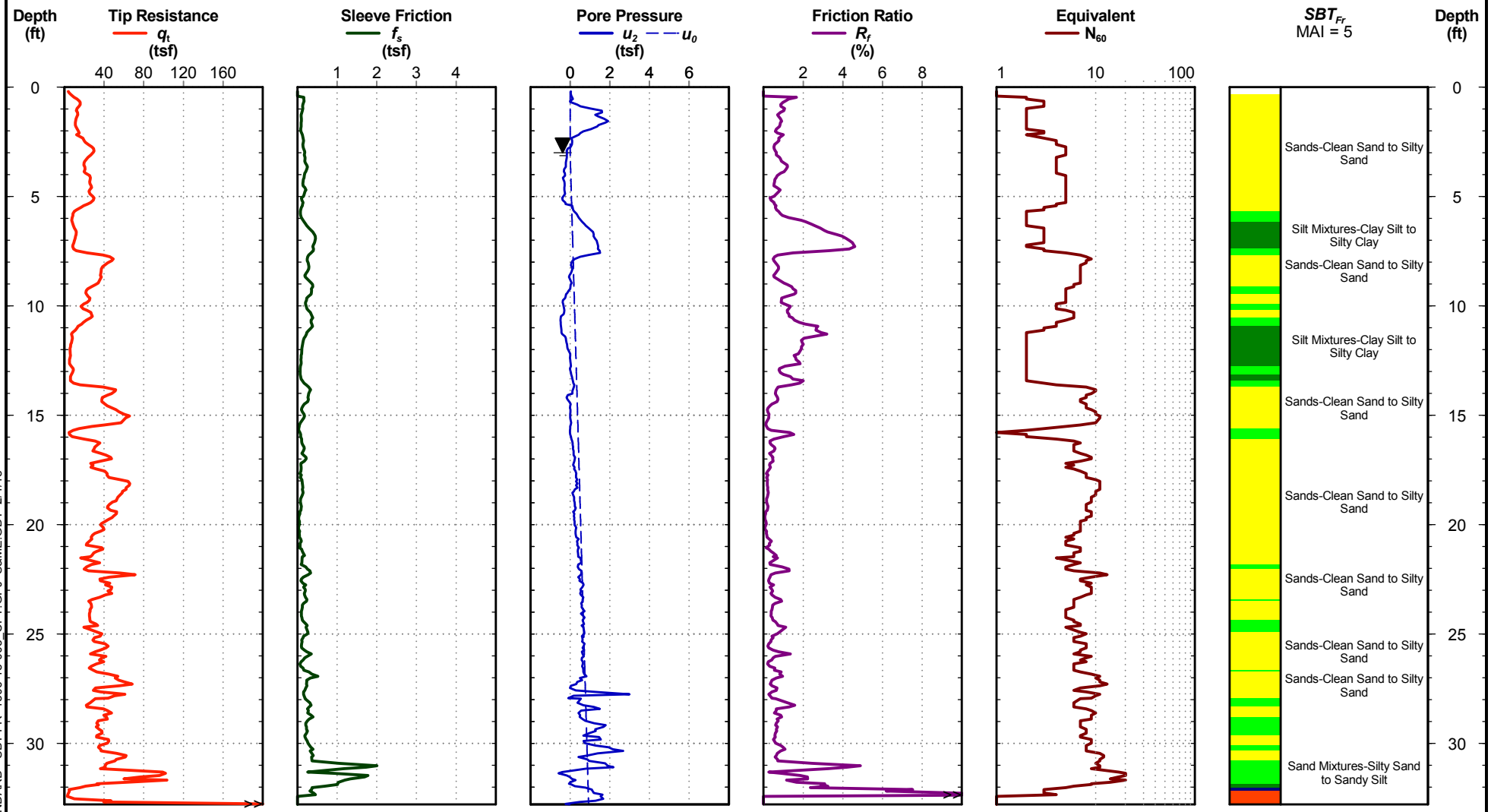
CPT REPORT - STANDARD - SBT FR 1306-18-003_CPT.GPJ S&ME.GDT 2/1/18

Electronic Filename: C-3(064)_PD.DAT

Sounding ID: C-4

Town Creek Elem/Middle
Winnabow, North Carolina
S&ME Project No: 1306-18-003

Date:	Jan. 31, 2018	**Total Depth:**	32.8 ft
Estimated Water Depth:	3 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Gyrotrack/A. Feix	**Cone Size:**	1.75



Cone Penetration Test

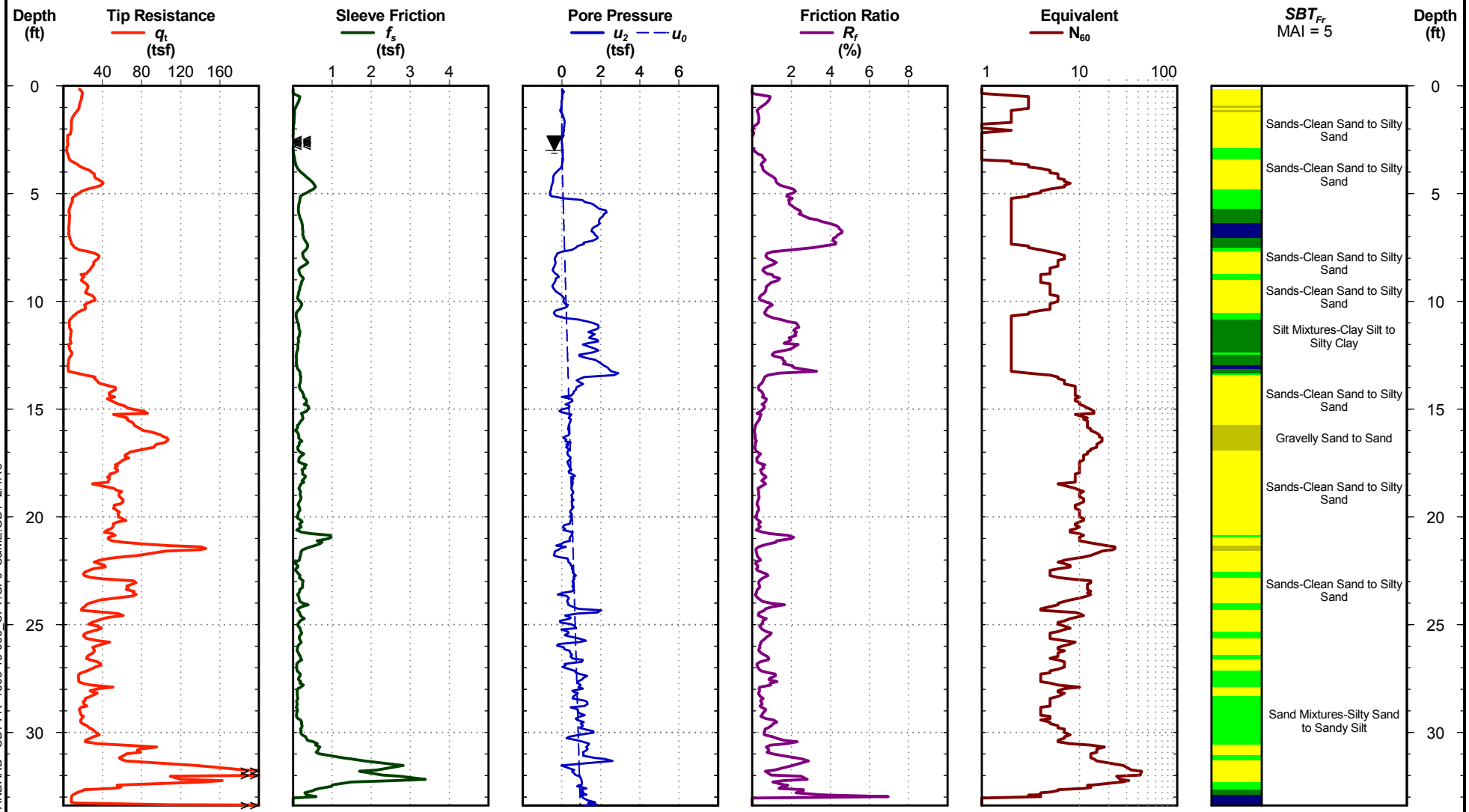
CPT REPORT - STANDARD - SBT FR 1306-18-003_CPT.GPJ S&ME.GDT 2/1/18

Electronic Filename: C-4(067)_PD.DAT

Sounding ID: C-5

Town Creek Elem/Middle
Winnabow, North Carolina
S&ME Project No: 1306-18-003

Date:	Jan. 31, 2018	**Total Depth:**	33.4 ft
Estimated Water Depth:	3 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Gyrotrack/A. Feix	**Cone Size:**	1.75



Cone Penetration Test

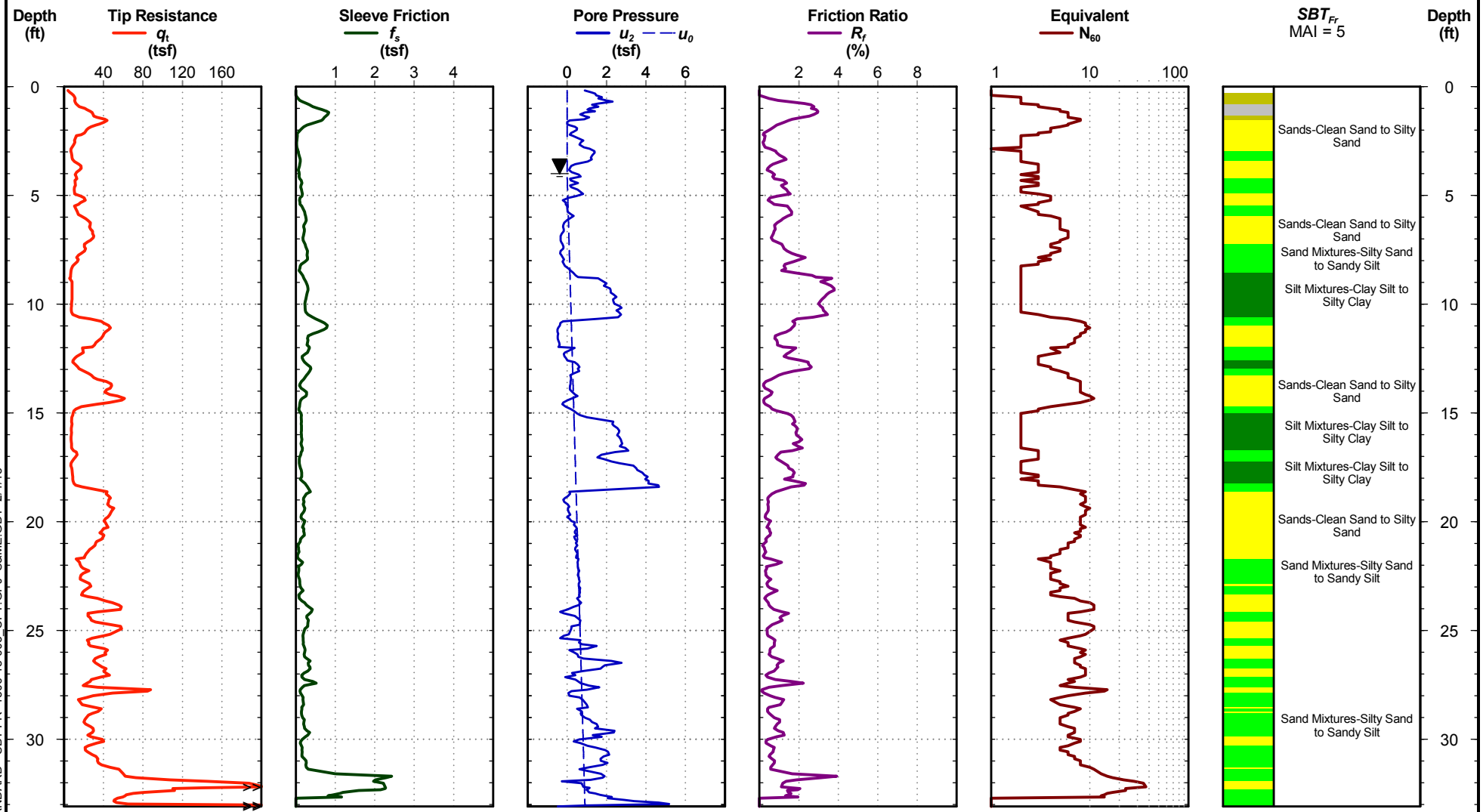
CPT REPORT - STANDARD - SBT FR 1306-18-003_CPT.GPJ S&ME.GDT 2/1/18

Electronic Filename: C-5(062)_PD.DAT

Sounding ID: C-6

Town Creek Elem/Middle
Winnabow, North Carolina
S&ME Project No: 1306-18-003

Date:	Jan. 31, 2018	**Total Depth:**	33.1 ft
Estimated Water Depth:	4 ft	**Termination Criteria:**	Maximum Reaction Force
Rig/Operator:	Gyrotrack/A. Feix	**Cone Size:**	1.75



Cone Penetration Test

CPT REPORT - STANDARD - SBT FR 1306-18-003_CPT.GPJ S&ME.GDT 2/1/18

Electronic Filename: C-5(062)_PD.DAT

Appendix III – Liquefaction Analysis Reports

S&ME
3201 Spring Forest Road
Raleigh, NC
919-872-2660

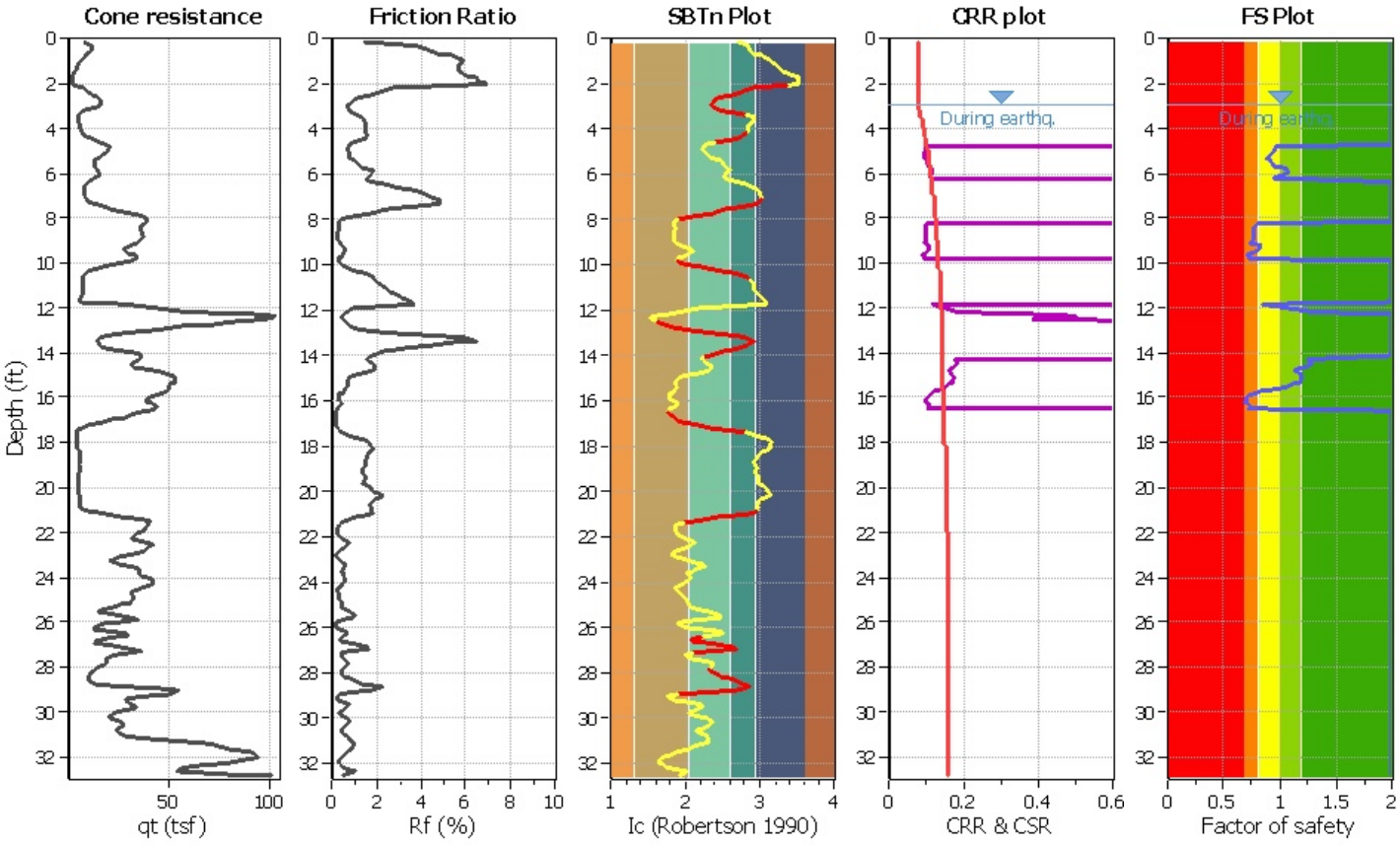
LIQUEFACTION ANALYSIS REPORT

Project title : Town Creek **Location : Winnabow, NC**

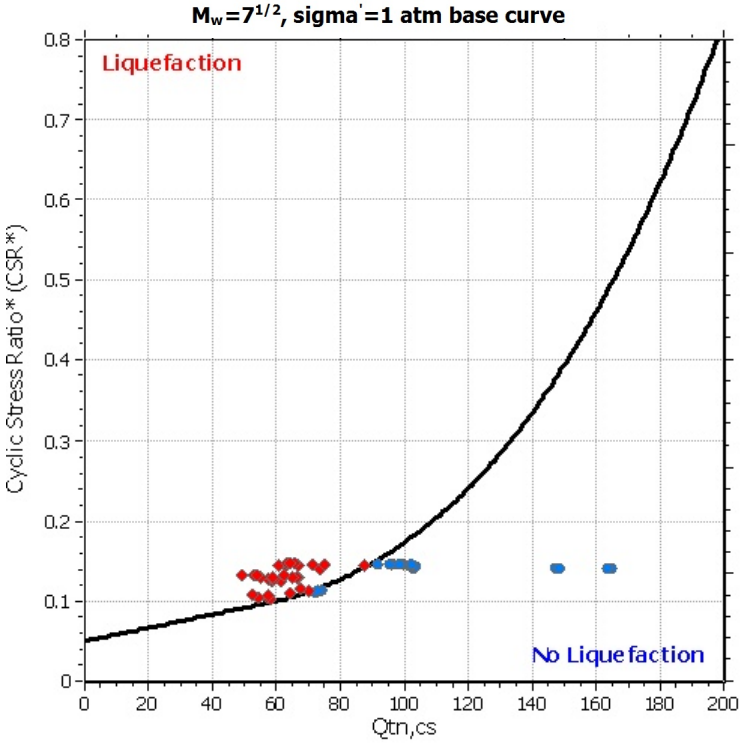
CPT file : C-1

Input parameters and analysis data

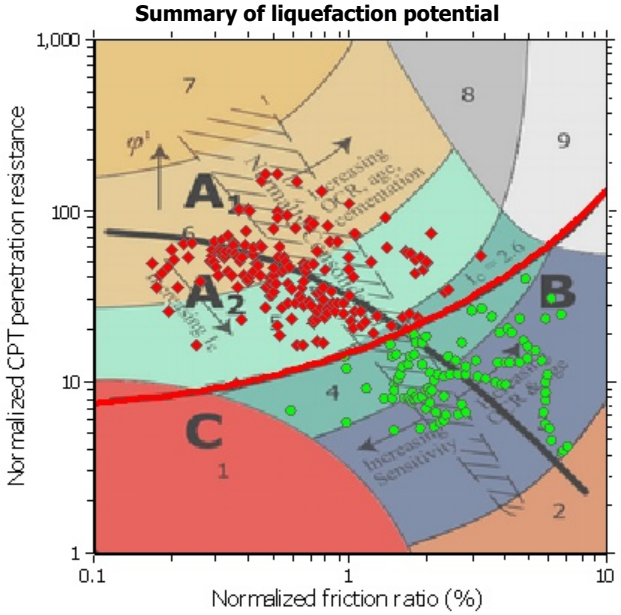
Analysis method:	NCEER (1998)	G.W.T. (in-situ):	3.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	3.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	21.00 ft
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



$M_w=7^{1/2}$, sigma'=1 atm base curve

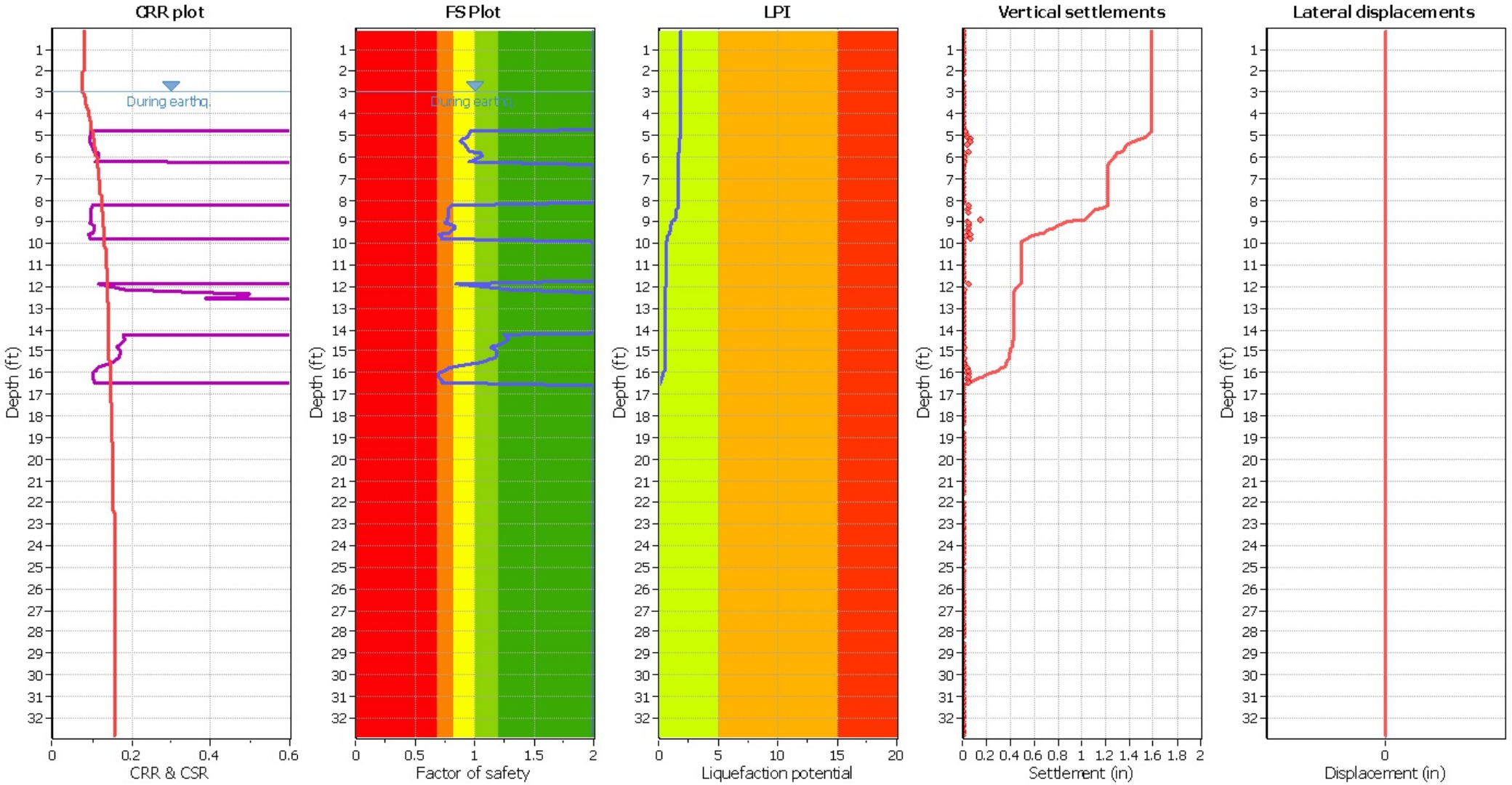


Summary of liquefaction potential



Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	3.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 ft	Fill height:	N/A	Limit depth:	21.00 ft

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

S&ME
3201 Spring Forest Road
Raleigh, NC
919-872-2660

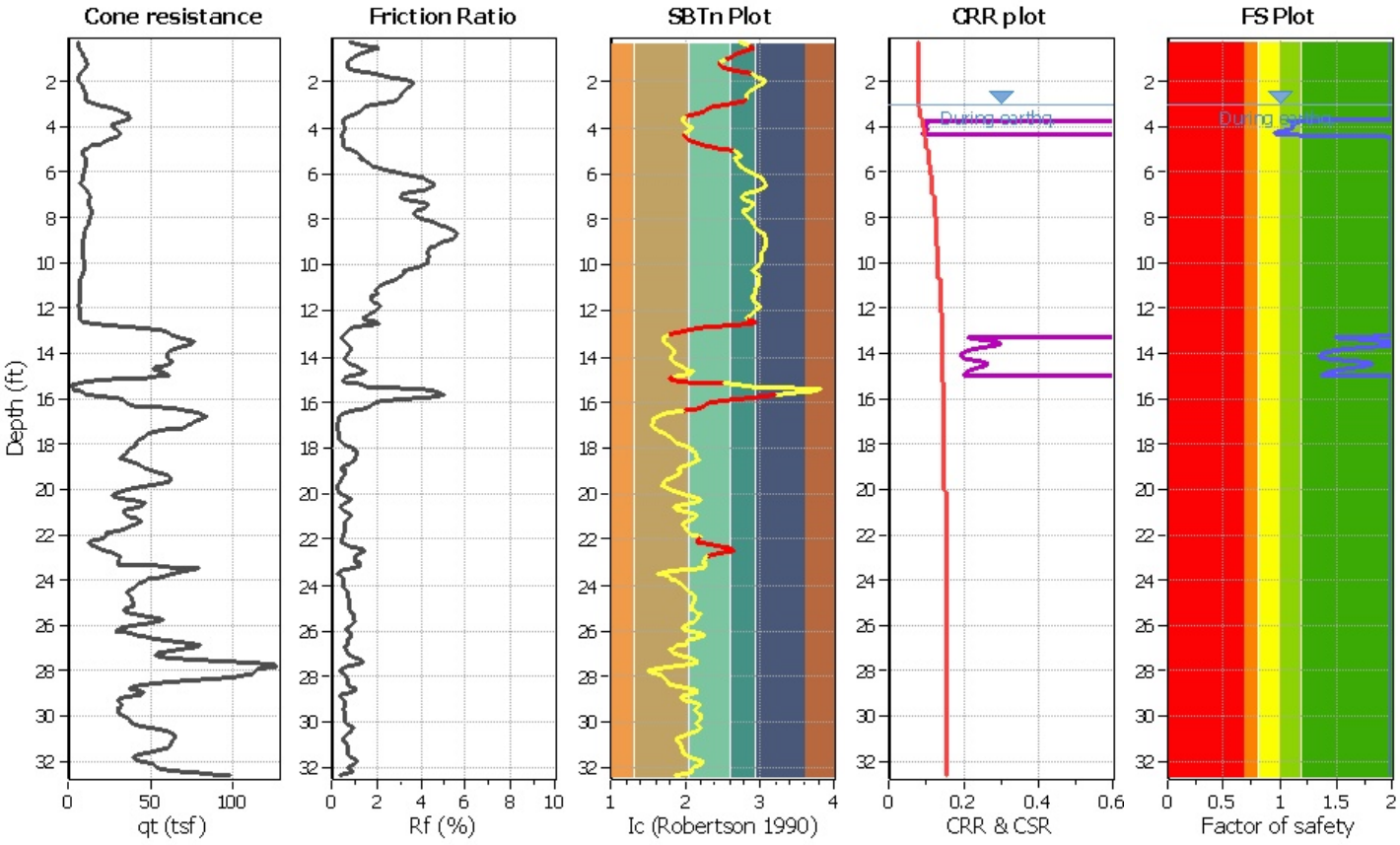
LIQUEFACTION ANALYSIS REPORT

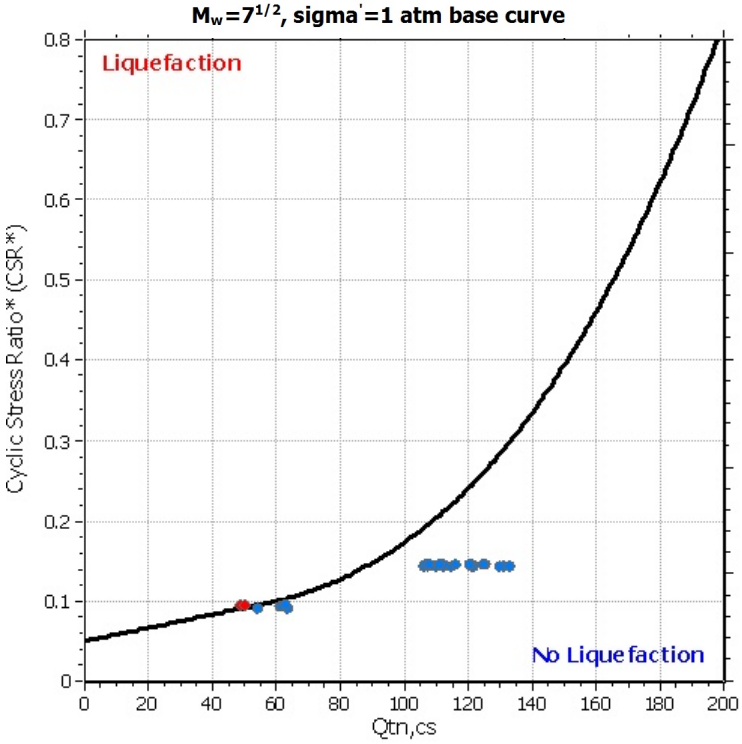
Project title : Town Creek **Location : Winnabow, NC**

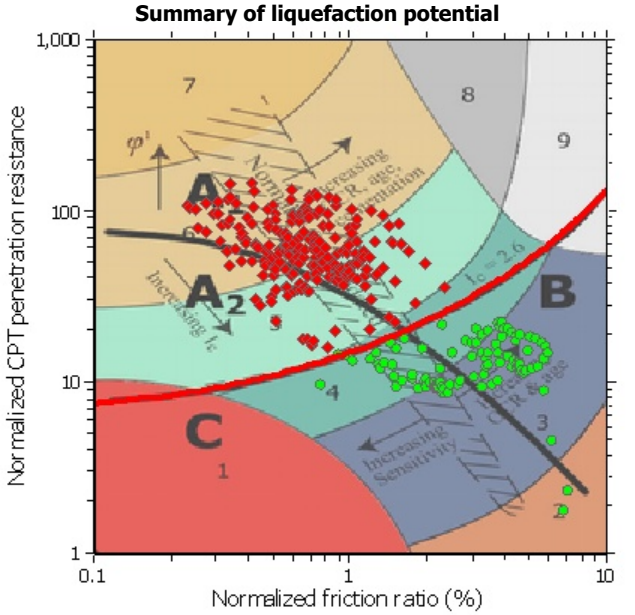
CPT file : C-2

Input parameters and analysis data

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Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	16.00 ft
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

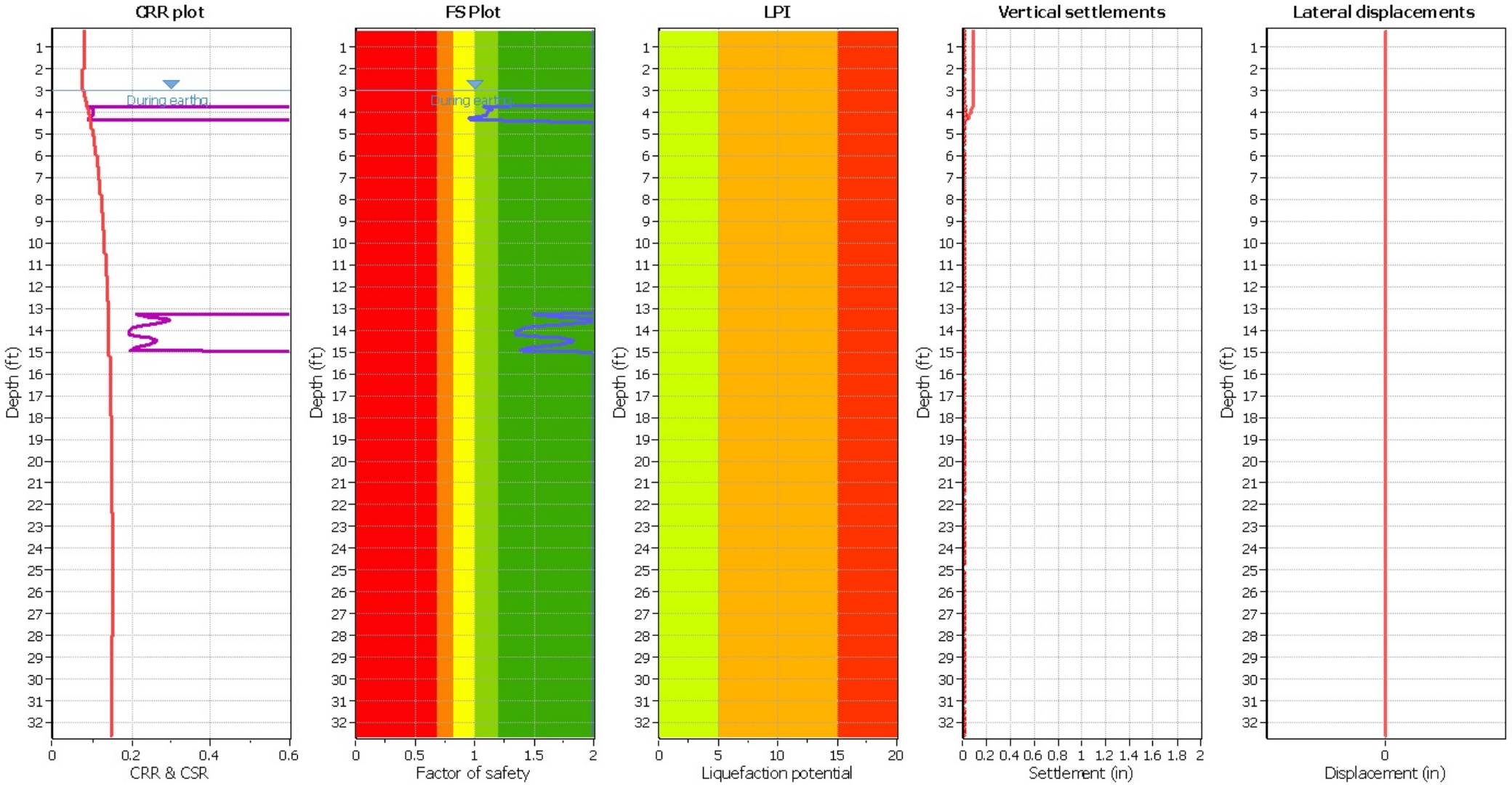






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	3.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 ft	Fill height:	N/A	Limit depth:	16.00 ft

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

S&ME
3201 Spring Forest Road
Raleigh, NC
919-872-2660

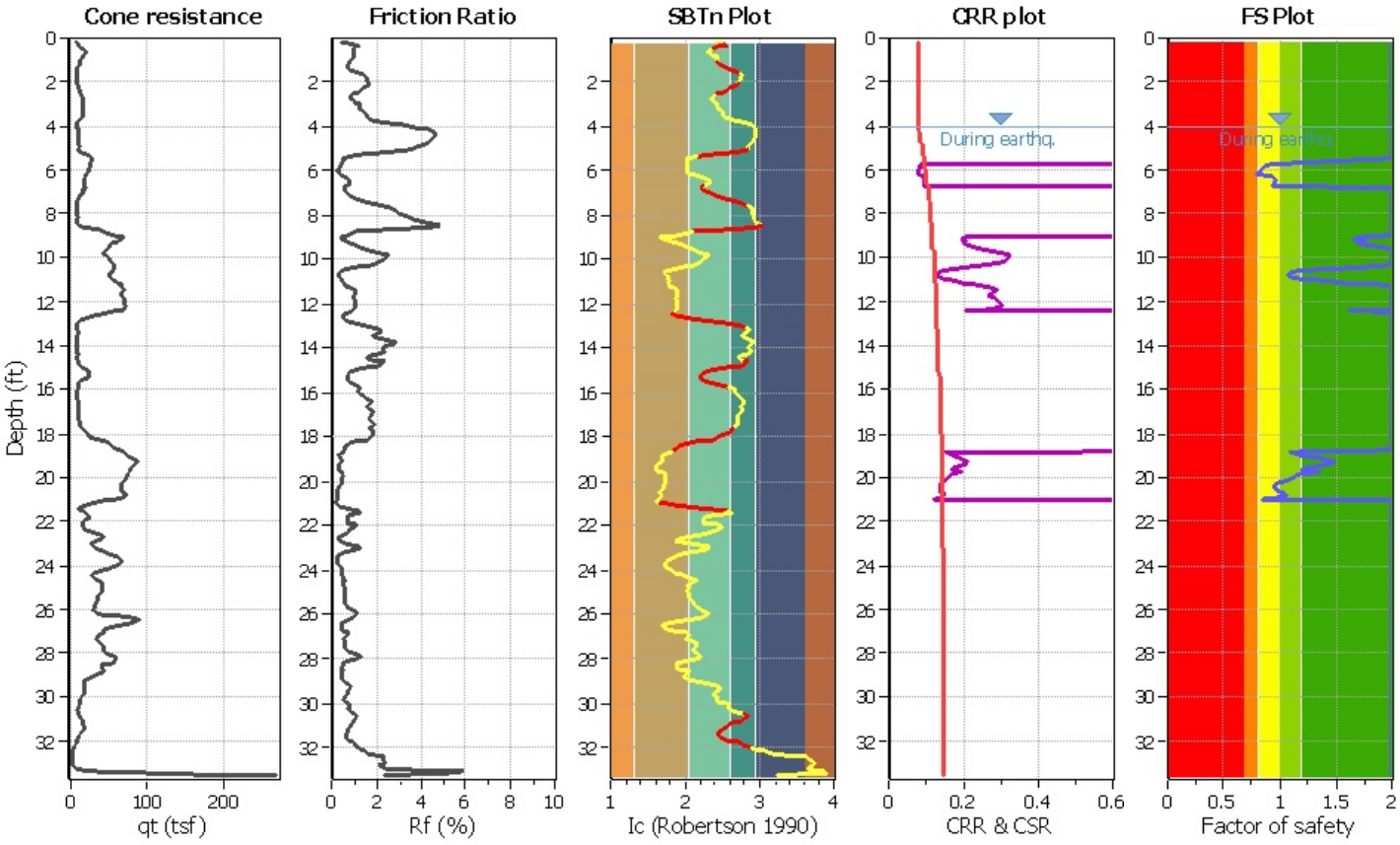
LIQUEFACTION ANALYSIS REPORT

Project title : Town Creek **Location : Winnabow, NC**

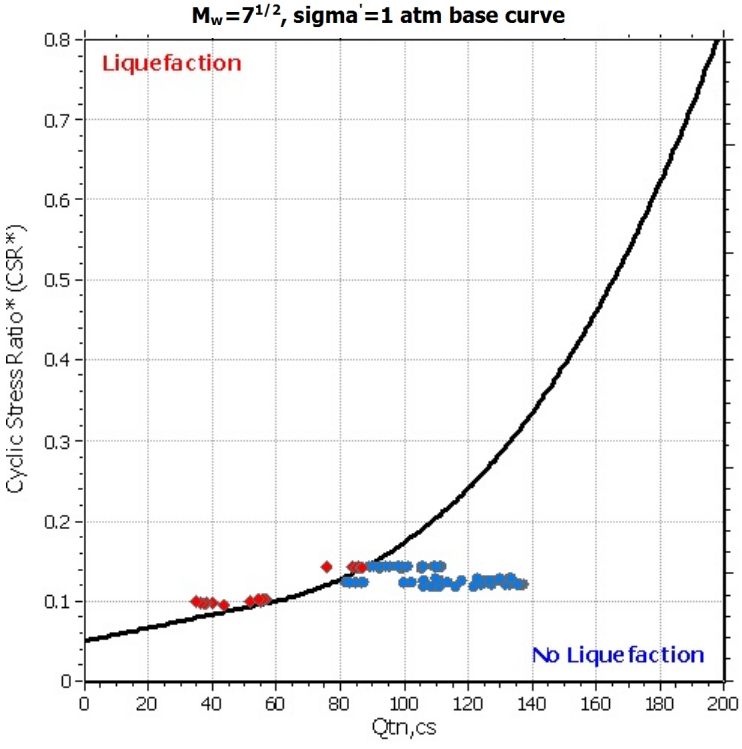
CPT file : C-3

Input parameters and analysis data

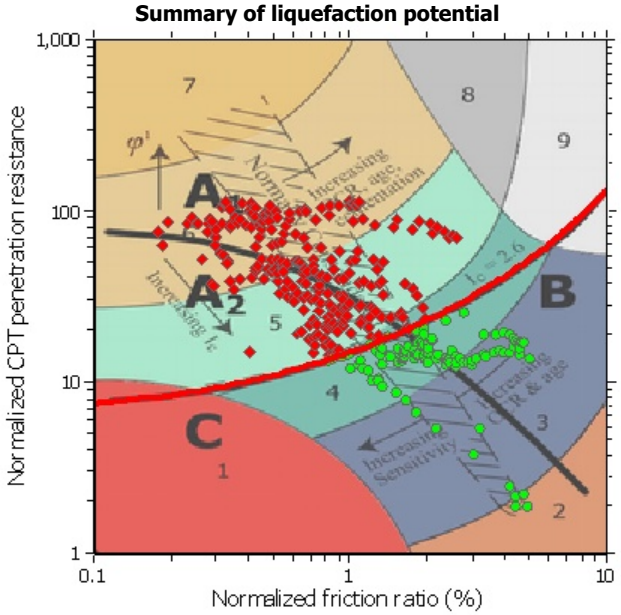
Analysis method:	NCEER (1998)	G.W.T. (in-situ):	4.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	4.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	21.00 ft
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



$M_w=7^{1/2}$, sigma'=1 atm base curve

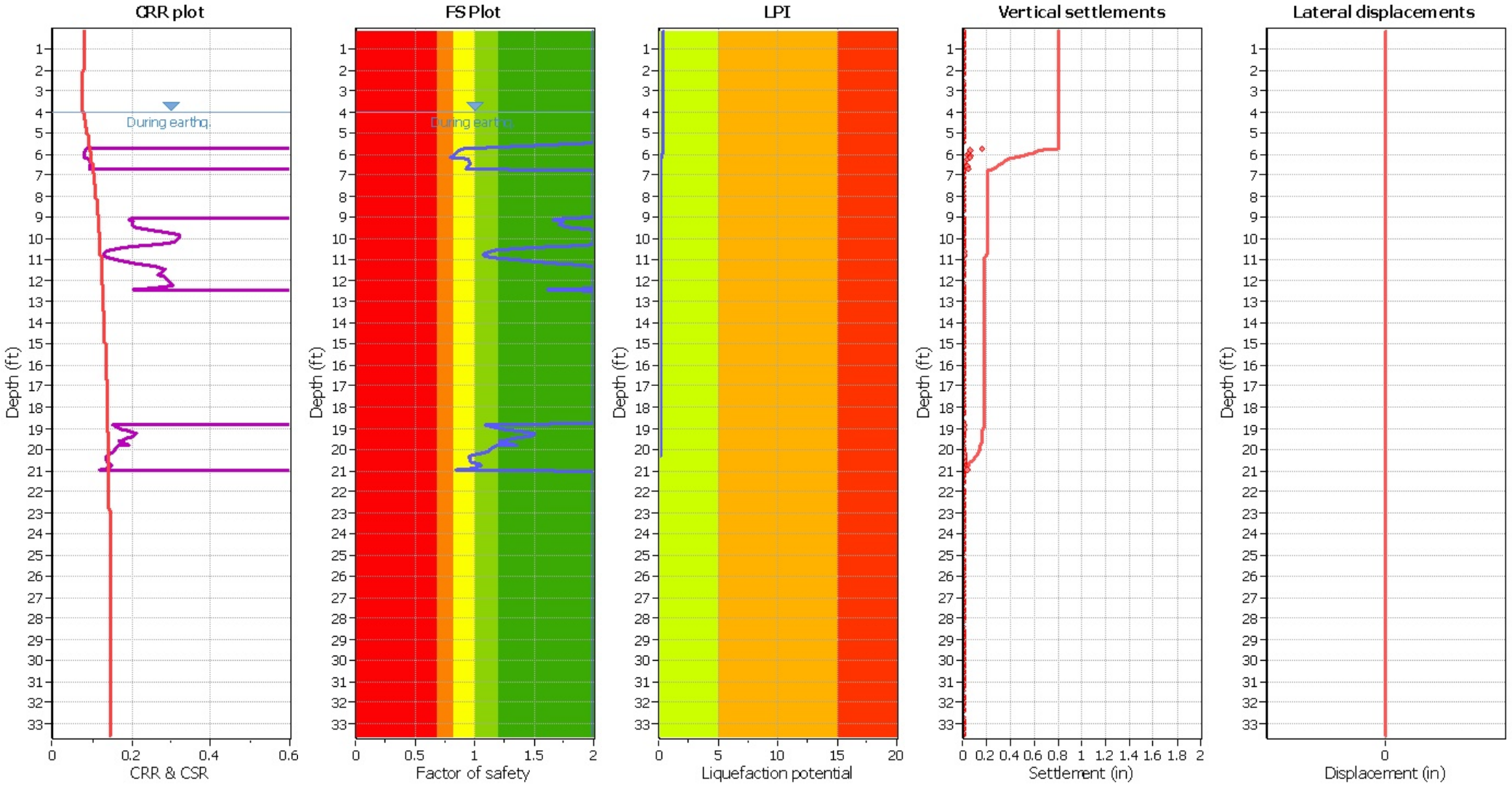


Summary of liquefaction potential



Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	4.00 ft	Fill height:	N/A	Limit depth:	21.00 ft

F.S. color scheme

- Almost certain it will liquefy
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LPI color scheme

- Very high risk
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S&ME
3201 Spring Forest Road
Raleigh, NC
919-872-2660

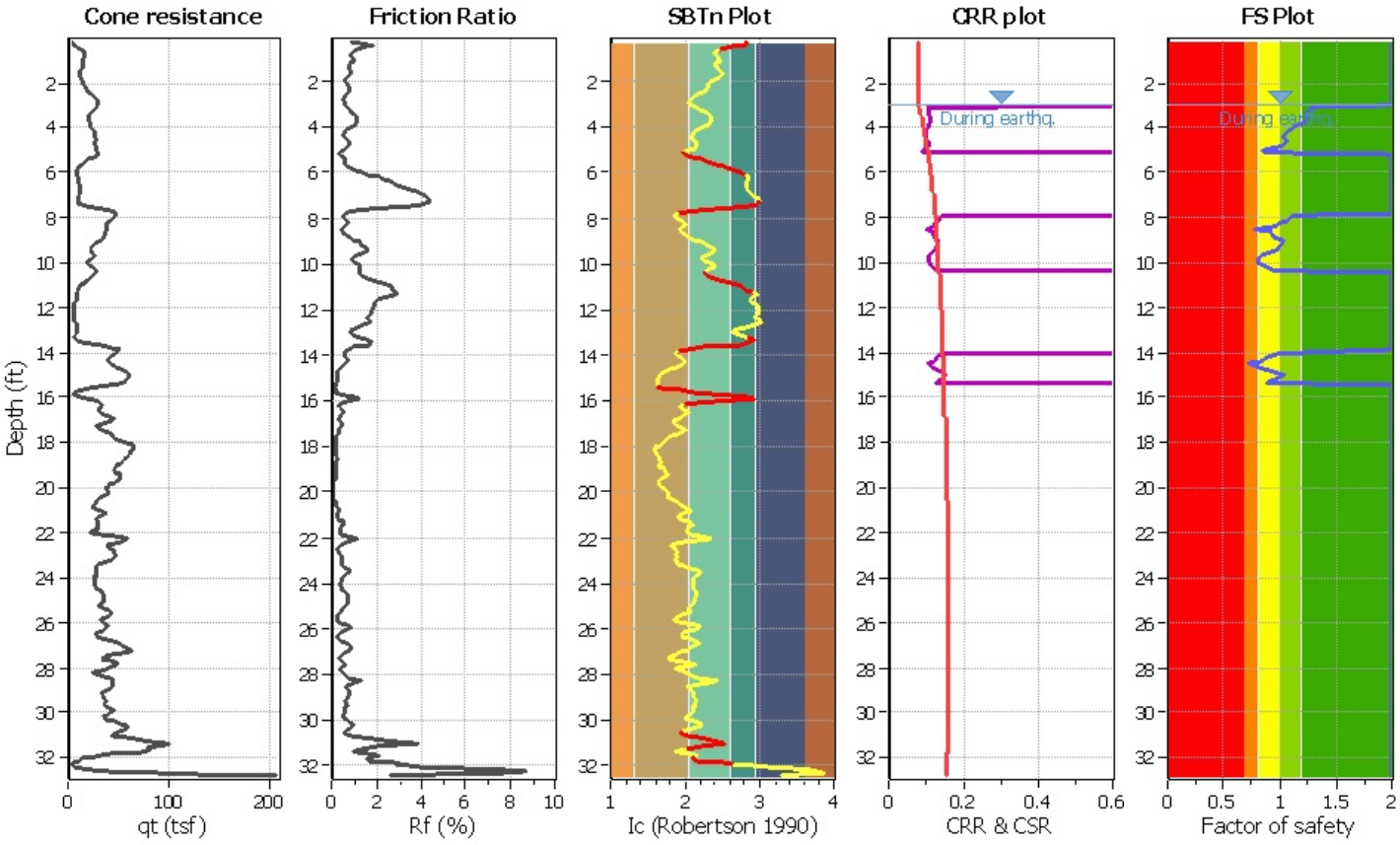
LIQUEFACTION ANALYSIS REPORT

Project title : Town Creek **Location : Winnabow, NC**

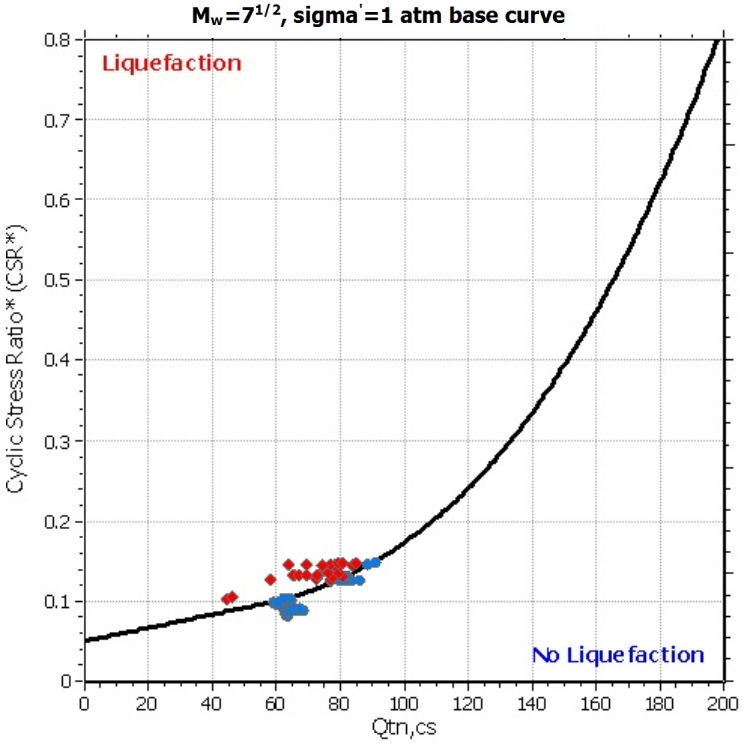
CPT file : C-4

Input parameters and analysis data

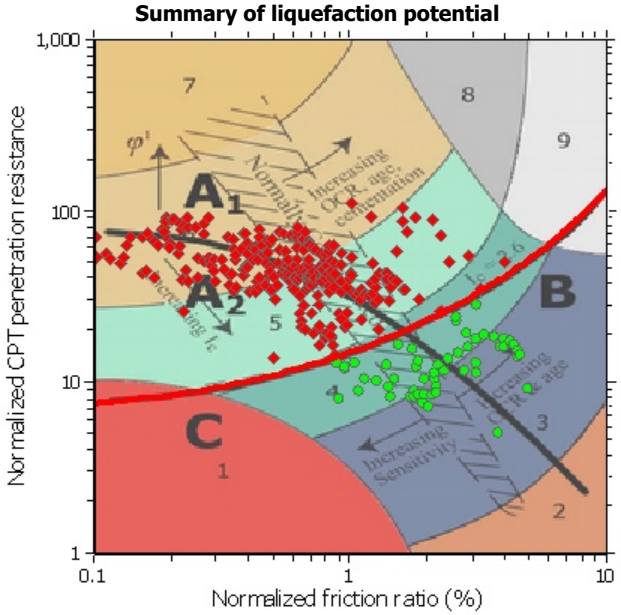
Analysis method:	NCEER (1998)	G.W.T. (in-situ):	3.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	3.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	16.00 ft
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



$M_w=7^{1/2}$, sigma'=1 atm base curve

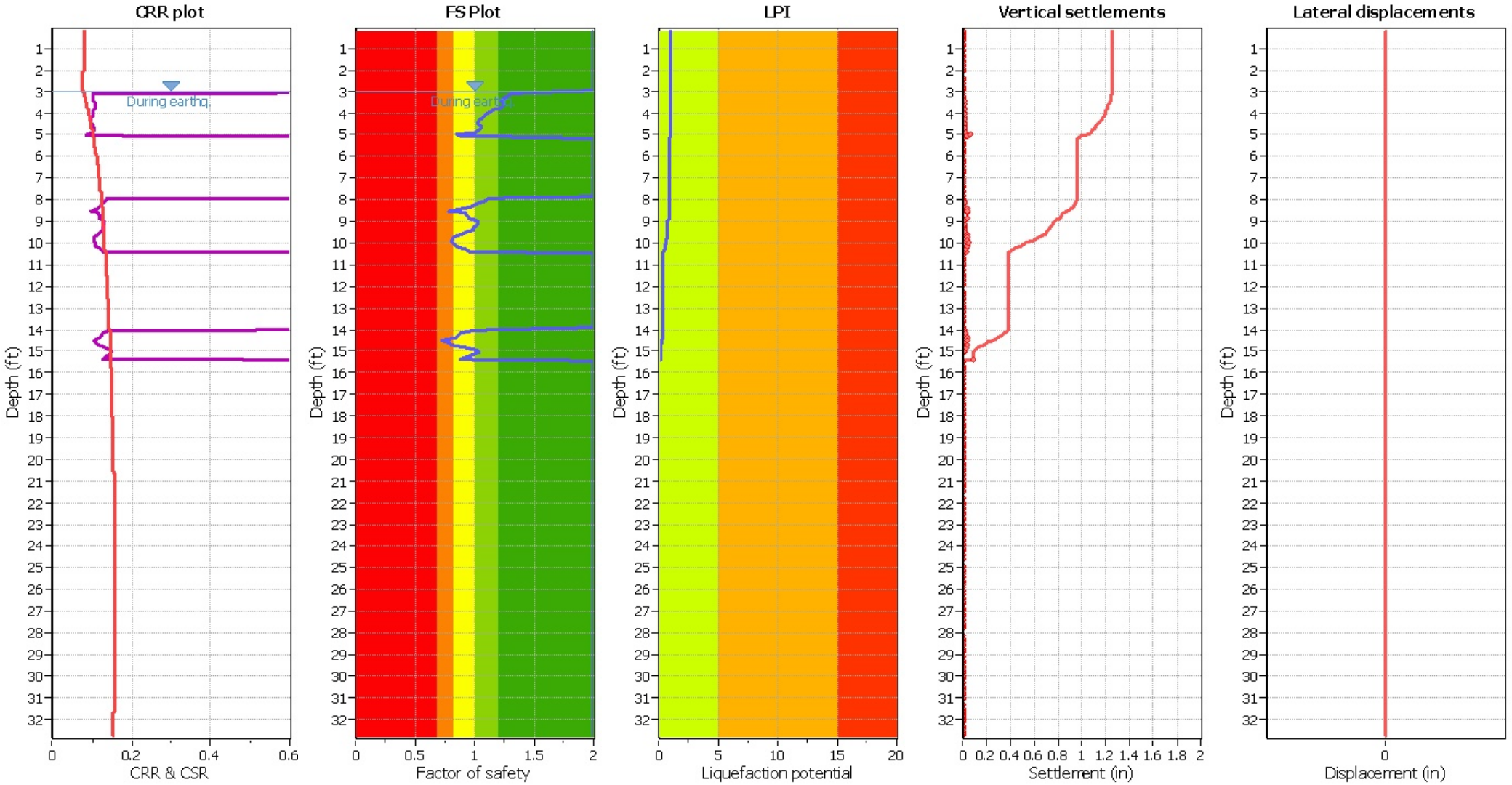


Summary of liquefaction potential



Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	3.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 ft	Fill height:	N/A	Limit depth:	16.00 ft

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

S&ME
3201 Spring Forest Road
Raleigh, NC
919-872-2660

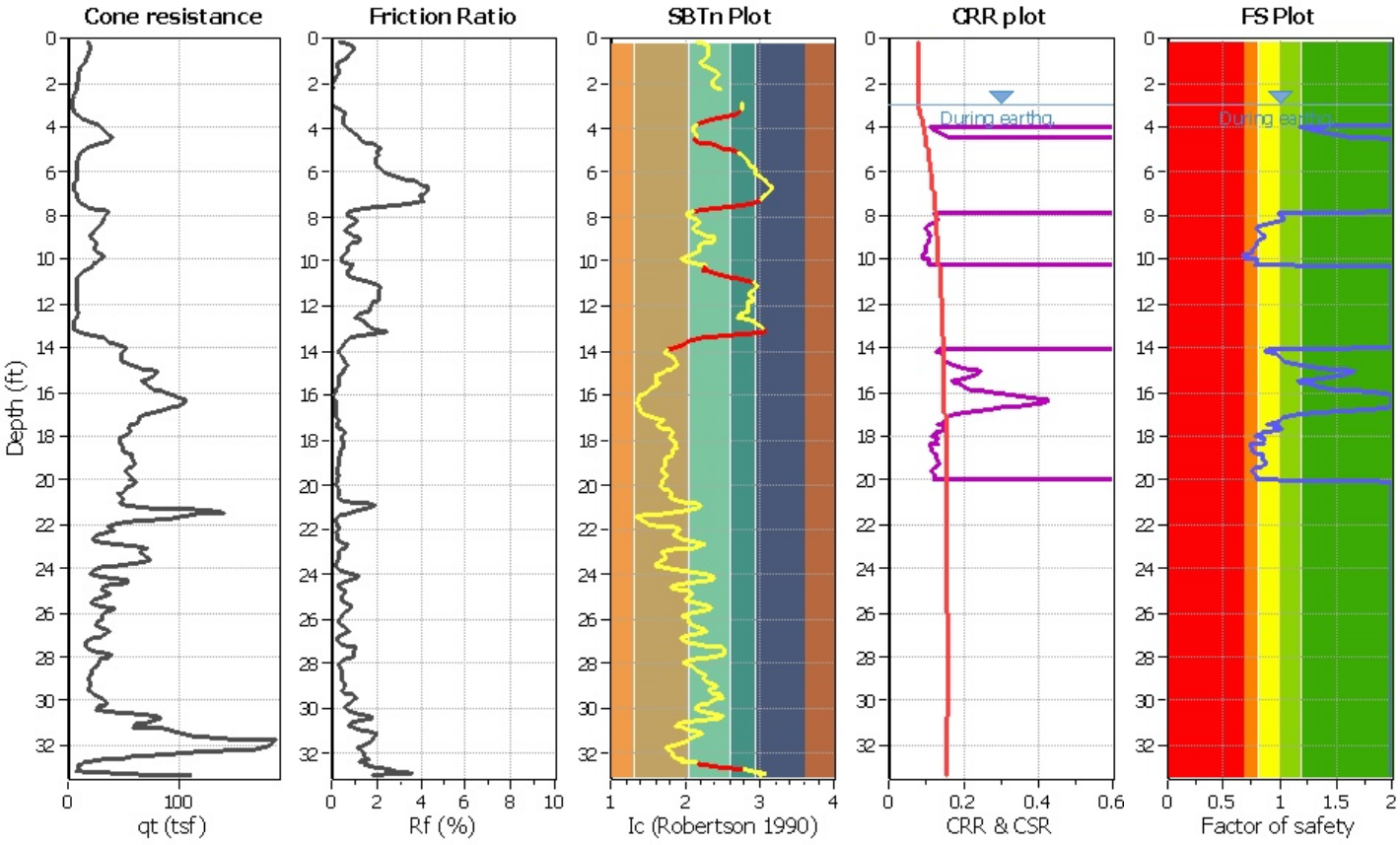
LIQUEFACTION ANALYSIS REPORT

Project title : Town Creek **Location : Winnabow, NC**

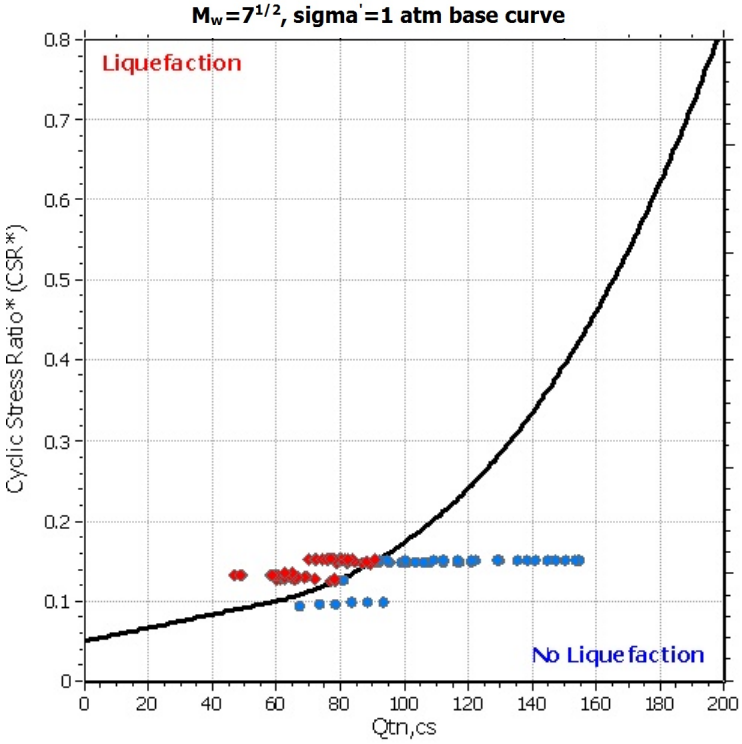
CPT file : C-5

Input parameters and analysis data

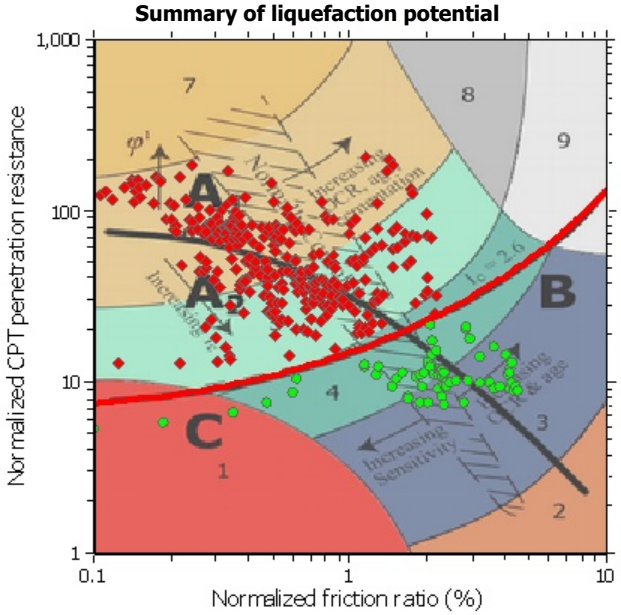
Analysis method:	NCEER (1998)	G.W.T. (in-situ):	3.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	3.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 ft
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



$M_w=7^{1/2}$, sigma'=1 atm base curve

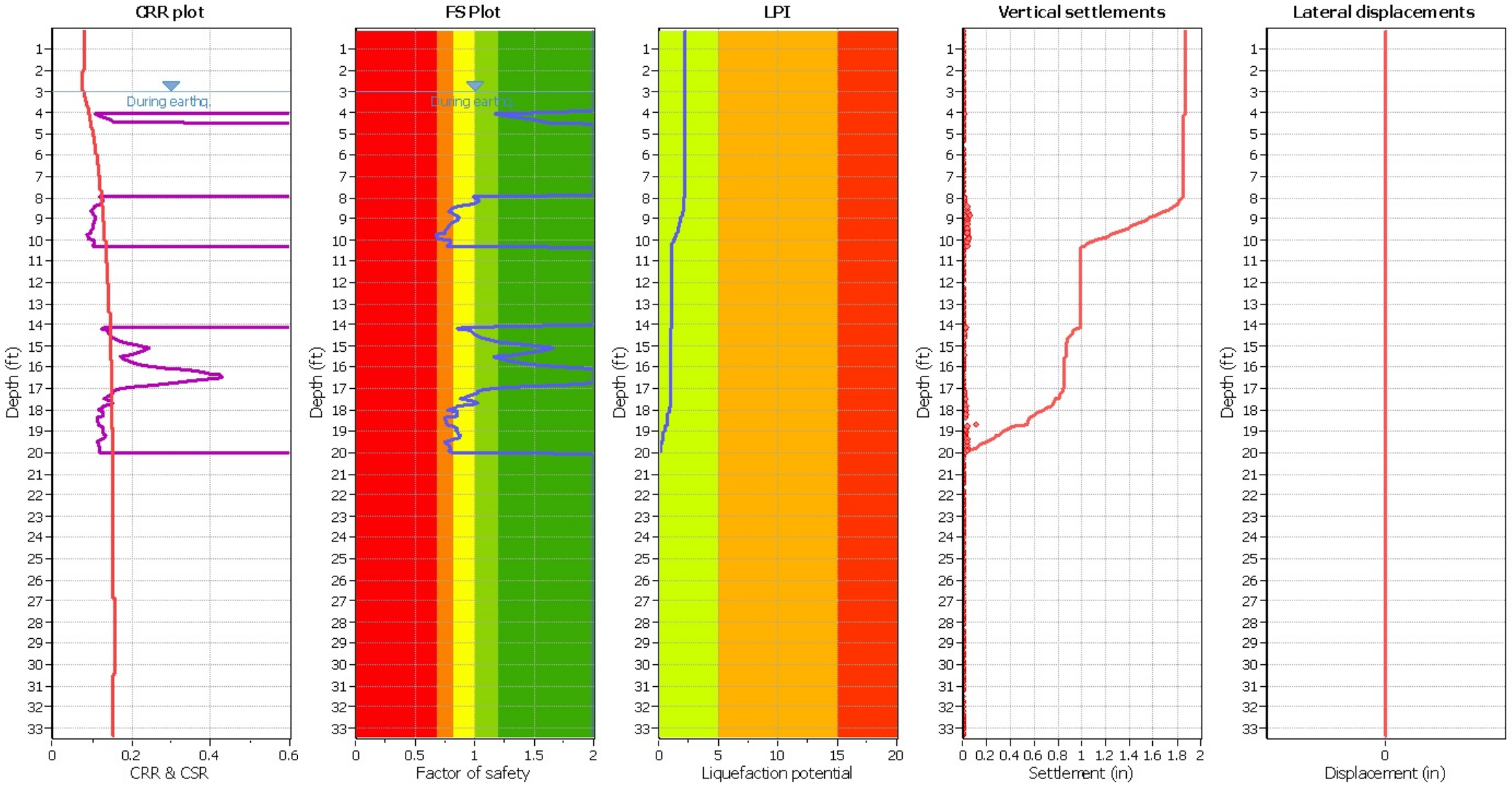


Summary of liquefaction potential



Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	3.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	3.00 ft	Fill height:	N/A	Limit depth:	20.00 ft

F.S. color scheme

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LPI color scheme

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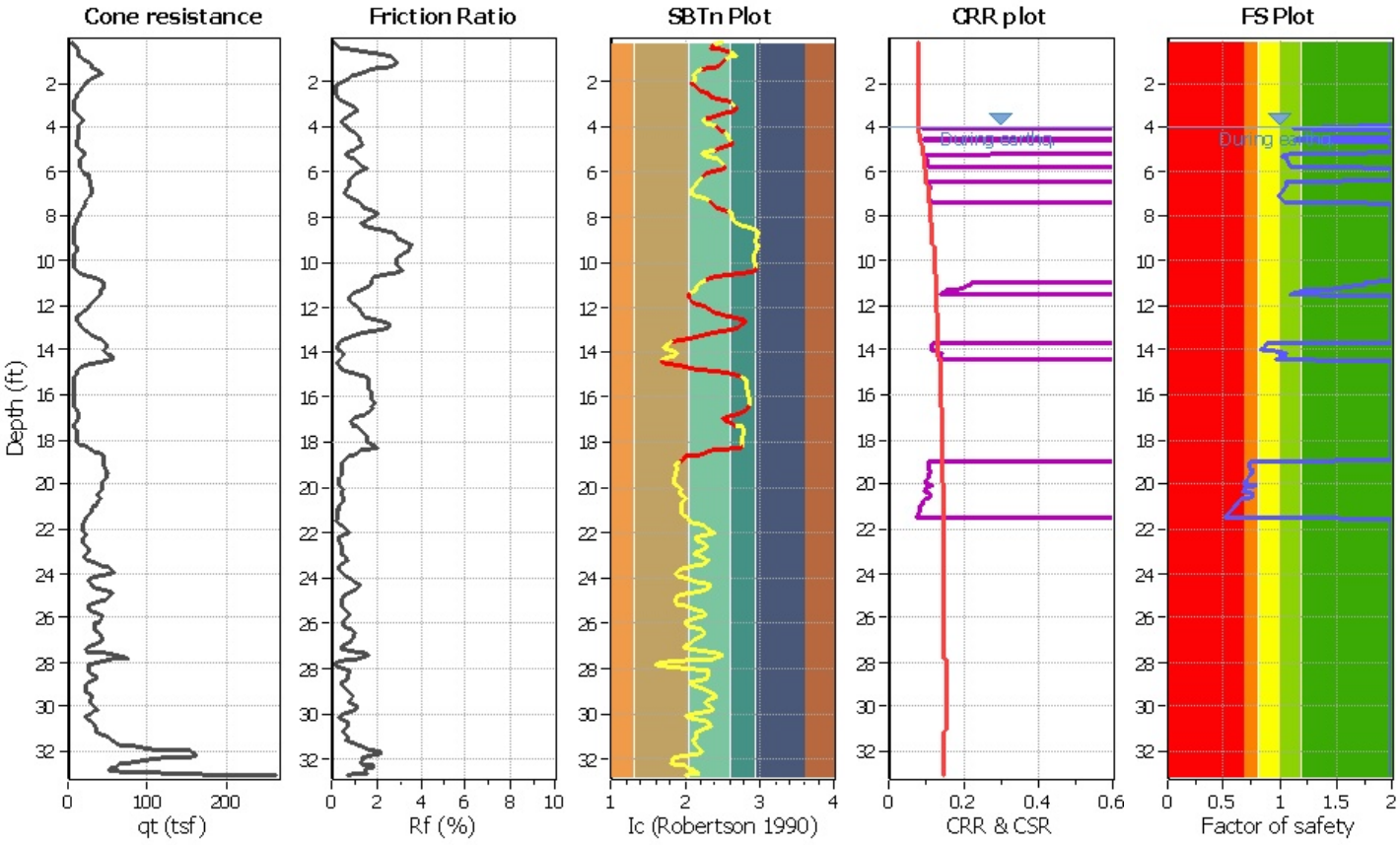
LIQUEFACTION ANALYSIS REPORT

Project title : Town Creek **Location : Winnabow, NC**

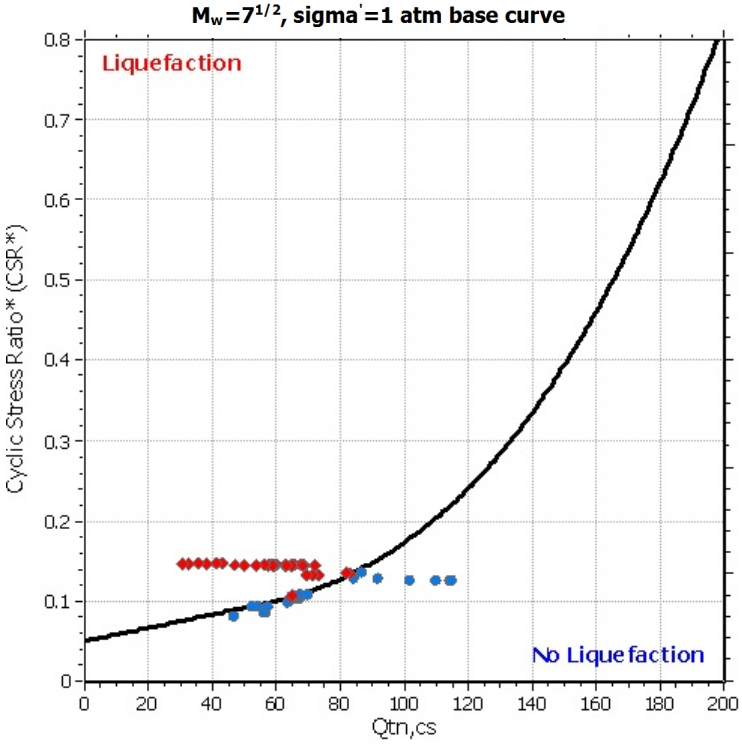
CPT file : C-6

Input parameters and analysis data

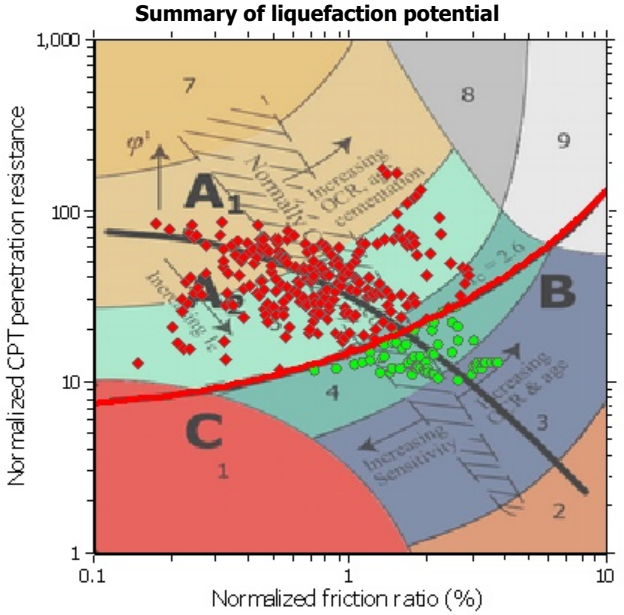
Analysis method:	NCEER (1998)	G.W.T. (in-situ):	4.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	4.00 ft	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	21.50 ft
Earthquake magnitude M_w:	7.30	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



$M_w=7^{1/2}$, sigma'=1 atm base curve

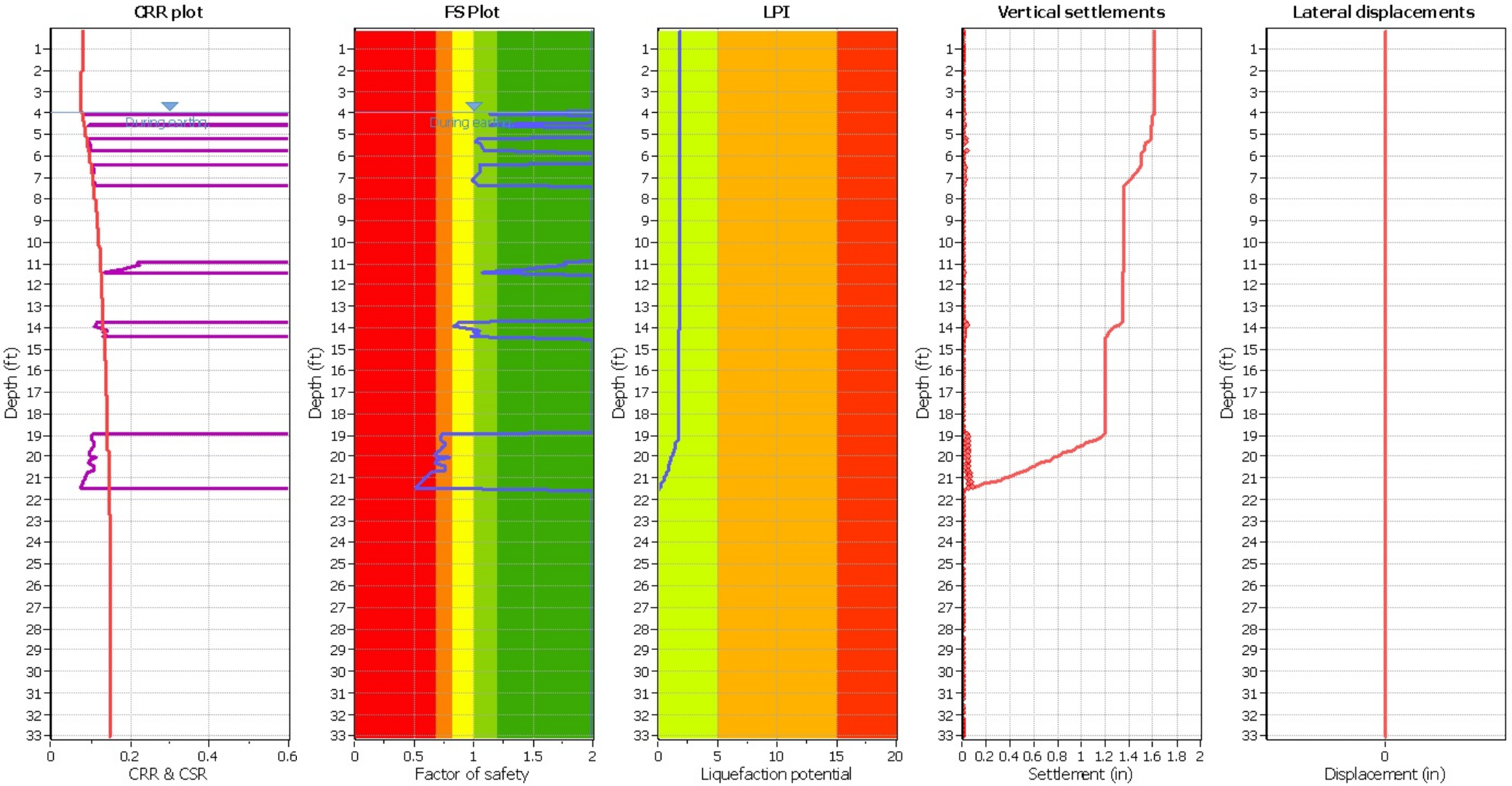


Summary of liquefaction potential



Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
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Liquefaction analysis overall plot



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	4.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.30	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	4.00 ft	Fill height:	N/A	Limit depth:	21.50 ft

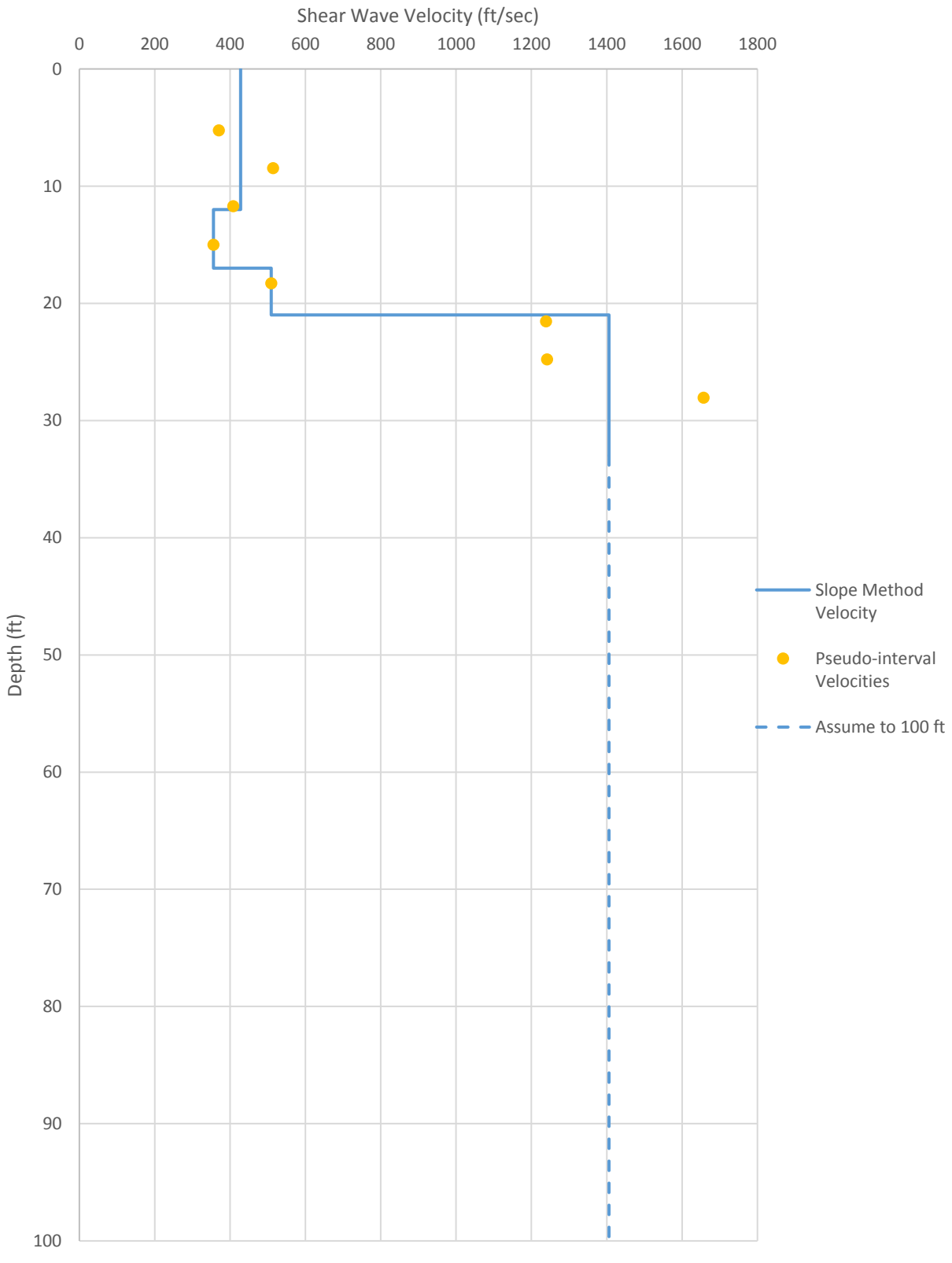
F.S. color scheme

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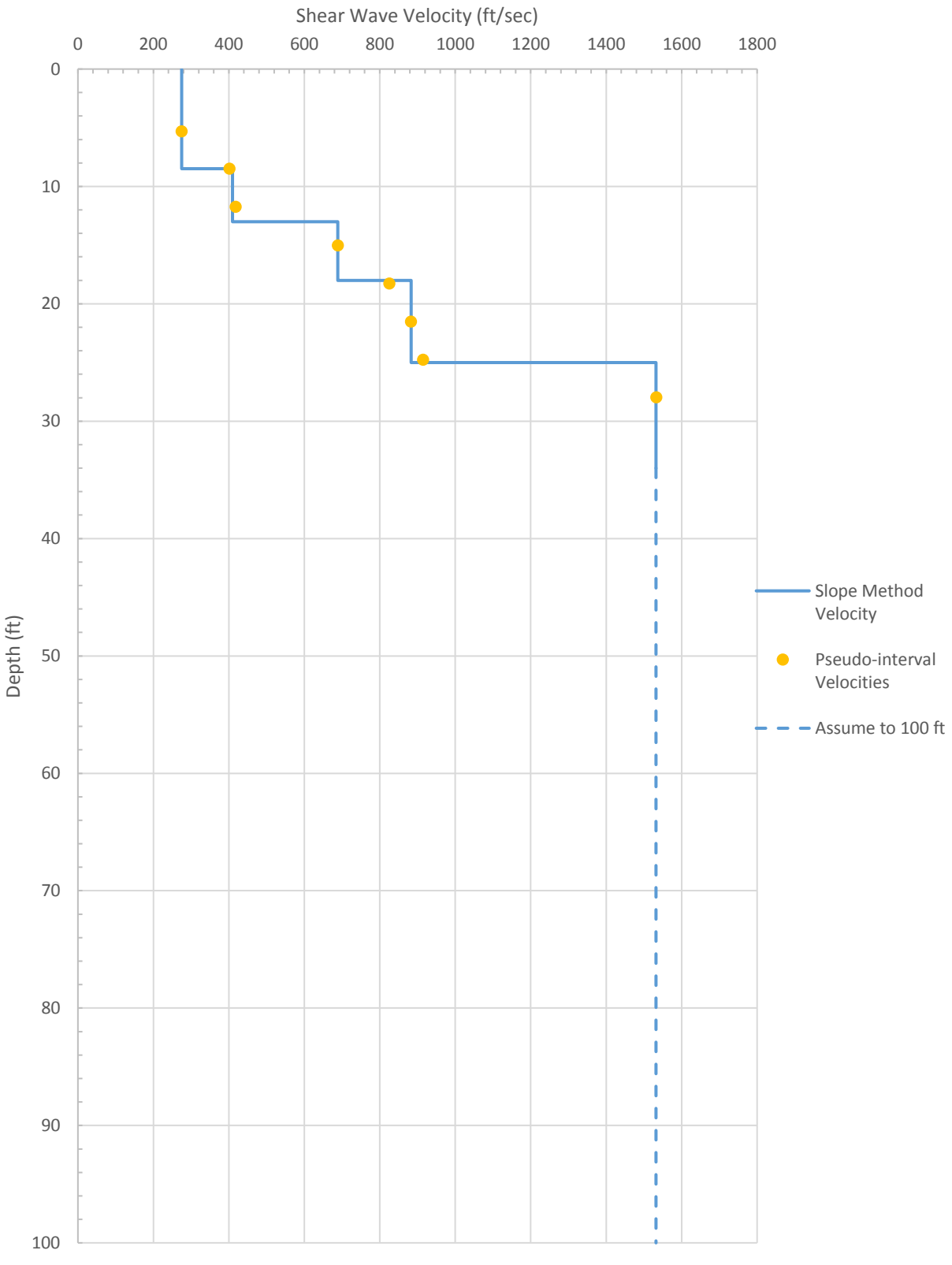
LPI color scheme

- Very high risk
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- Low risk

Appendix IV – Shear Wave Velocity Profiles



Drawn by: A. Yetman		**Shear Wave Velocity Profile**	Fig. No.
Checked by: K. Brown		Town Creek Elementary & Middle Schools Winnabow, NC	3
Date: 2/1/2018		Proj. No. 1306-18-003 C-1	



Drawn by: A. Yetman		**Shear Wave Velocity Profile**	Fig. No.
Checked by: K. Brown		Town Creek Elementary & Middle Schools Winnabow, NC	2
Date: 2/1/2018		Proj. No. 1306-18-003 C-3	

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Work covered by the Contract Documents.
   2. Type of the Contract.
   3. Owner-furnished products.
   4. Specification formats and conventions.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Town Creek Middle School.
   1. Project Location: Winnabow, North Carolina.

B. Owner: Brunswick County Schools.

C. Architect: KSQ Design, 1930 Camden Road, Suite 260, Charlotte, North Carolina 28203.

D. Construction Manager: W. M. Jordan Company.

E. The Work for the Building consists of the following:
   1. Town Creek Middle School is approximately 91,000 SF of new construction, steel frame with storefront, curtainwall and a brick veneer. The building consists of a flat TPO roof covering the two-story Classroom wings along with the Gym/Stage, Administrative, Kitchen, Music and Art Room areas, with sloped metal roof at the Entry, Dining and Media Center as indicated on the Drawings and as specified in the Project Manual.

1.03 TYPE OF CONTRACT

A. Project will be constructed under a CM@Risk Contract with the Owner.

1.04 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment scheduled.
   1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Construction Manager for Owner furnished materials. Schedule for delivery of shop drawings, product date and samples required will be agreed upon by Owner and Contractor.
   2. Owner will arrange and pay for delivery of Owner-furnished items according to Construction Manager's Construction Schedule.
   3. After delivery, Owner will inspect delivered items for damage. Construction Manager shall be present for and assist in Owner's inspection.
   4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
   5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Construction Manager.
   6. Owner will furnish Construction Manager the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Construction Manager shall designate delivery dates of Owner-furnished items in Construction Manager's Construction Schedule.
   7. Construction Manager shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
   8. Construction Manager is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
   9. Construction Manager is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.

10. If Owner-furnished items are damaged as a result of Construction Manager's operations, Construction Manager shall repair or replace them.
11. Construction Manager shall install and otherwise incorporate Owner-furnished items into the Work.

B. Owner-Furnished Products:
1. Toilet Accessories.
2. Smart Boards.

C. Owner-Furnished Owner-Installed Items:
1. Wrestling Mat.
2. Wrestling Mat Lift.
3. Shower Curtains and Hooks.
4. Instrument Lockers.
5. Adjustable Storage Shelving.
6. Copiers.
7. Large Screen Televisions.

1.05 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated.

1.06 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterForm 2012" numbering system.

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Construction Manager. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Construction Manager or by others when so noted.
a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.
   1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Change Order.

B. Types of allowances include the following:
   1. Unit-cost allowances.

C. Related Sections include the following:
   1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders for allowances.

1.03 SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.04 COORDINATION

A. Coordinate allowance items with other portions of the Work.

1.05 UNIT-COST ALLOWANCES

A. Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.02 SCHEDULE OF ALLOWANCES

A. Section 04 20 00 - Unit Masonry: Include the stipulated sum of $825.00 per thousand for purchase and delivery of field brick including required special shapes.

B. Section 04 20 00 - Unit Masonry: Include the stipulated sum of $785.00 per thousand for purchase and delivery of wainscot brick including required special shapes.

END OF SECTION

SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Related Sections include the following:
   1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.02 DEFINITIONS

A. Unit price is a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.03 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner 's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A list of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 LIST OF UNIT PRICES

A. Unit Price No. 1 - Compacted Fill from On-Site Borrow:
   1. Description: Compacted fill from on-site borrow according to the Civil Drawings.
   2. Unit of Measurement: One (1) Cubic Yard measured in place by cross section.

B. Unit Price No. 2 - Compacted Fill from Off-Site Borrow:
   1. Description: Compacted fill from off-site borrow according to the Civil Drawings
   2. Unit of Measurement: One (1) Cubic Yard measured in place by cross section.

C. Unit Price No. 3 - Structural Fill from Off-Site Borrow:
   1. Description: Compacted structural fill from off-site borrow according to the Civil Drawings.
   2. Unit of Measurement: One (1) Cubic Yard measured in place by cross section.

D. Unit Price No. 4 - Structural Fill from On-Site Borrow:
   1. Description: Compacted structural fill from on-site borrow according to the Civil Drawings.
   2. Unit of Measurement: One (1) Cubic Yard measured in place by cross section.

E. Unit Price No. 5 - Unsuitable Soil Removal and Replacement:
   1. Description: Removal of unsuitable soil and replacement with compacted structural fill according to Division 31 Section "Unsuitable Soil Removal."
   2. Unit of Measurement: One (1) Cubic Yard measured in place by cross section to be filled with unsuitable soil wasted off site..

END OF SECTION

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:
   1. Division 01 Section "Unit Prices" for administrative requirements for using unit prices.
   2. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.03 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.04 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
   2. Within 14 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Construction Manager-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.

5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

1.05 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
   3. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.06 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.07 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections include the following:
   1. Division 01 Section "Unit Prices" for administrative requirements governing use of unit prices.
   2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Construction Manager's Construction Schedule and Submittals Schedule.

1.03 DEFINITIONS

A. Schedule of Values: A statement furnished by Construction Manager allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Construction Manager's Applications for Payment.

1.04 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Construction Manager's Construction Schedule.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with Continuation Sheets.
      b. Submittals Schedule.
      c. Construction Manager's Construction Schedule.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Architect's project number.
      d. Construction Manager's name and address.
      e. Date of submittal.
   2. Submit draft of AIA Document G703 Continuation Sheets.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.

6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Construction Manager's option.
8. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.05 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Construction Manager. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Construction Manager. Architect will return incomplete applications without action.
   1. Entries shall match data on the Schedule of Values and Construction Manager's Construction Schedule. Use updated schedules if revisions were made.
   2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   3. Submit draft application to the Architect a minimum of 7 days prior to application due date for review.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
   5. Waiver Forms: Submit waivers of lien on forms indicated in the Project Manual.

G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of Values.
   3. Construction Manager's Construction Schedule (preliminary if not final).
   4. Products list.

5. Schedule of unit prices.
6. Submittals Schedule (preliminary if not final).
7. List of Construction Manager's staff assignments.
8. List of Construction Manager's principal consultants.
9. Copies of building permits.
10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
11. Initial progress report.
12. Report of preconstruction conference.
13. Certificates of insurance and insurance policies.
14. Performance and payment bonds.
15. Data needed to acquire Owner's insurance.
16. Initial settlement survey and damage report if required.

H. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

I. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination Drawings.
   2. Administrative and supervisory personnel.
   3. Project meetings.
   4. Requests for Interpretation (RFIs).

B. Related Sections include the following:
   1. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.03 DEFINITIONS

A. RFI: Request from Construction Manager seeking interpretation or clarification of the Contract Documents.

1.04 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.
   4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Construction Manager's Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Project closeout activities.

8. Startup and adjustment of systems.
9. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.05 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
b. Indicate required installation sequences.
c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. BIM File Incorporation: Construction Manager will incorporate Contractor's coordination drawing files into Building Information Model established for Project.
a. Construction Manager will perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
3. Architect will furnish Construction Manager one set of digital data files of Drawings for use in preparing coordination digital data files.
a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

C. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.06 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1.07 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.

3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Construction Manager and its project manager, superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Critical work sequencing and long-lead items.
      c. Designation of key personnel and their duties.
      d. Procedures for processing field decisions and Change Orders.
      e. Procedures for RFIs.
      f. Procedures for testing and inspecting.
      g. Procedures for processing Applications for Payment.
      h. Distribution of the Contract Documents.
      i. Submittal procedures.
      j. Preparation of Record Documents.
      k. Responsibility for temporary facilities and controls.
      l. Parking availability.
      m. Office, work, and storage areas.
      n. Equipment deliveries and priorities.
      o. First aid.
      p. Security.
      q. Progress cleaning.
      r. Working hours.
   3. Minutes: Record and distribute meeting minutes.

C. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.
   1. Attendees: In addition to representatives of Owner and Architect, each subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Construction Manager's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Construction Manager's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Review schedule for next period.
      b. Review present and future needs of each entity present, including the following:
         1) Interface requirements.
         2) Sequence of operations.
         3) Status of submittals.
         4) Deliveries.

5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Status of correction of deficient items.
14) Field observations.
15) RFIs.
16) Status of proposal requests.
17) Pending changes.
18) Status of Change Orders.
19) Pending claims and disputes.
20) Documentation of information for payment requests.

3. Minutes: Record the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
   a. Schedule Updating: Revise Construction Manager's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

D. Coordination Meetings: Conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
   1. Attendees: In addition to representatives of Construction Manager, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings.
   2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   3. Reporting: Construction Manager shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.08 REQUESTS FOR INTERPRETATION (RFI'S)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI in the form specified.
   1. RFIs shall originate with Construction Manager. RFIs submitted by entities other than Construction Manager will be returned with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Construction Manager's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation and the following:
   1. Project name.
   2. Date.
   3. Name of Construction Manager.
   4. Name of Architect.
   5. RFI number, numbered sequentially.
   6. Specification Section number and title and related paragraphs, as appropriate.
   7. Drawing number and detail references, as appropriate.
   8. Field dimensions and conditions, as appropriate.

9. Construction Manager's suggested solution(s). If Construction Manager's solution(s) impact the Contract Time or the Contract Sum, Construction Manager shall state impact in the RFI.
10. Construction Manager's signature.
11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.
    a. Supplementary drawings prepared by subcontractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. Software-Generated RFIs: Software-generated form with substantially the same content as indicated above.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow seven working days for Architect's response for each RFI. RFIs received after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for coordination information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Architect's actions on submittals.
    f. Incomplete RFIs or RFIs with numerous errors.
2. Architect's action may include a request for additional information, in which case Architect's time for response will start again.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Construction Manager to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    a. If Construction Manager believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Construction Manager disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:
1. Project name.
2. Name and address of Construction Manager.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Preliminary Construction Schedule.
   2. Construction Manager's Construction Schedule.
   3. Submittals Schedule.
   4. Daily construction reports.

B. Related Sections include the following:
   1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.

1.03 SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Working electronic copy of schedule file, where indicated.
   2. PDF electronic file.

B. Startup construction schedule.
   1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Construction Manager's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
   1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. Construction Schedule Updating Reports: Submit with Applications for Payment.

F. Daily Construction Reports: Submit at weekly intervals.

G. Special Reports: Submit at time of unusual event.

1.04 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Construction Manager's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Construction Manager's Construction Schedule.
   2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Construction Manager's Construction Schedule.

2.02 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
   2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Construction Manager's Construction Schedule with Submittals Schedule.
   4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

E. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

2.03 PRELIMINARY CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule within seven days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.04 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
   1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.05 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Equipment at Project site.
   5. Material deliveries.
   6. High and low temperatures and general weather conditions.
   7. Accidents.
   8. Meetings and significant decisions.
   9. Unusual events (refer to special reports).
   10. Stoppages, delays, shortages, and losses.
   11. Meter readings and similar recordings.
   12. Emergency procedures.
   13. Orders and requests of authorities having jurisdiction.
   14. Change Orders received and implemented.
   15. Field Orders received and implemented.
   16. Services connected and disconnected.
   17. Equipment or system tests and startups.
   18. Partial Completions and occupancies.
   19. Project Acceptances authorized.

PART 3 - EXECUTION

3.01 CONSTRUCTION MANAGER'S CONSTRUCTION SCHEDULE

A. Construction Manager's Construction Schedule Updating: At monthly intervals, or more frequently as required to ensure schedule is being met, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, and other parties identified by Construction Manager with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:
   1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
   2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
   3. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
   4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.02 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.03 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.

c. Submittal category: Action; informational.
d. Name of subcontractor.
e. Description of the Work covered.
f. Scheduled date for Architect's final release or approval.
g. Scheduled date of fabrication.
h. Scheduled dates for purchasing.
i. Scheduled dates for installation.
j. Activity or event number.

1.04 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
   1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
      a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
      b. The following digital data files will by furnished for each appropriate discipline:
         1) Floor plans.
         2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 14 days for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
   5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 14 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.
    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-06 10 00.01.A).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner, containing the following information:
    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number, numbered consecutively.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.
    d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   2. Submit electronic submittals via email as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   3. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each copy of each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Manufacturer's product specifications.
      c. Standard color charts.
      d. Statement of compliance with specified referenced standards.
      e. Testing by recognized testing agency.
      f. Application of testing agency labels and seals.
      g. Notation of coordination requirements.
      h. Availability and delivery time information.
   4. For equipment, include the following in addition to the above, as applicable:
      a. Wiring diagrams showing factory-installed wiring.
      b. Printed performance curves.
      c. Operational range diagrams.
      d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
   5. Submit Product Data before or concurrent with Samples.
   6. Submit Product Data in the following format:
      a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.

f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Submit Shop Drawings in the following format:
   a. PDF electronic file.
3. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
   a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
   b. Refer to Section 01 31 00 "Project Management and Coordination" for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
   1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
   2. Identification: Attach label on unexposed side of Samples that includes the following:
      a. Generic description of Sample.
      b. Product name and name of manufacturer.
      c. Sample source.
      d. Number and title of applicable Specification Section.
      e. Specification paragraph number and generic name of each item.
   3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
   4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
      a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
      b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
   5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
      a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
   6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
      a. Number of Samples: Submit two sets of Samples. Architect will retain one Sample set; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
         1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
   1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
   2. Manufacturer and product name, and model number if applicable.
   3. Number and name of room or space.
   4. Location within room or space.
   5. Submit product schedule in the following format:
      a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.

2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.02 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and two paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.
   1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Construction Manager of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Construction Manager's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Construction Manager to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include the following:
   1. Divisions 2 through 33 Sections for specific test and inspection requirements.

1.03 DEFINITIONS

A. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

B. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

C. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

D. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

E. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

F. Installer/Applicator/Erector: Construction Manager or another entity engaged by Construction Manager as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.

1.04 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.05 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Reports: Prepare and submit certified written reports that include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.06 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

G. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship.
   4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   6. Demolish and remove mockups when directed, unless otherwise indicated.

1.07 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Construction Manager with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Construction Manager, and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Construction Manager's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Construction Manager by authorities having jurisdiction, whether specified or not.
   1. Where services are indicated as Construction Manager's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Construction Manager shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Construction Manager's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Construction Manager and not required by the Contract Documents are Construction Manager's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Construction Manager's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Architect and Construction Manager in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Architect and Construction Manager promptly of irregularities or deficiencies observed in the Work during performance of its services.
   2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
   3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
   4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Construction Manager.
   5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
   6. Do not perform any duties of Construction Manager.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
   1. Access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
   4. Facilities for storage and field curing of test samples.
   5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
   6. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
   1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.08 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:
   1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
   2. Notifying Architect and Construction Manager promptly of irregularities and deficiencies observed in the Work during performance of its services.
   3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Construction Manager and to authorities having jurisdiction.
   4. Submitting a final report of special tests and inspections at Project Acceptance, which includes a list of unresolved deficiencies.
   5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
   6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
   1. Date test or inspection was conducted.
   2. Description of the Work tested or inspected.
   3. Date test or inspection results were transmitted to Architect.
   4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.02 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Construction Manager's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections include the following:
   1. Division 01 Section "Execution Requirements" for progress cleaning requirements.

1.03 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to Architect, testing agencies, and authorities having jurisdiction.

B. Water Service: Pay water service use charges for water used by all entities for construction operations.

C. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.04 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2 inch (50 mm), 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts, with 1-5/8 inch (42 mm) OD top and bottom rails. Provide galvanized steel bases for supporting posts. Provide screening as approved by the Architect.

B. Lumber and Plywood: Comply with requirements in Division 06 Section "Miscellaneous Carpentry."

2.02 TEMPORARY FACILITIES

A. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 12 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4 foot (1.2 m) square tack board.
   3. Drinking water and private toilet.
   4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
   5. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
   1. Store combustible materials apart from building.

2.03 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

B. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

C. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

D. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

E. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Install lighting for Project identification sign.

F. Telephone Service:
   1. At each telephone, post a list of important telephone numbers.
      a. Police and fire departments.
      b. Ambulance service.
      c. Construction Manager's home office.
      d. Architect's office.
      e. Engineers' offices.

f. Owner's office.
g. Principal subcontractors' field and home offices.

2. Provide superintendent with cellular telephone for use when away from field office.

G. Electronic Communication: Provide temporary electronic communication, including electronic mail, in common-use facilities.
1. Provide wireless broadband in primary field office.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
1. Provide incombustible construction for sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
2. Maintain support facilities until Substantial Completion. Personnel remaining after Project Acceptance will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Project Identification and Temporary Signs: Provide Project identification and other signs approved by the Owner and Architect. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution Requirements" for progress cleaning requirements.

E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

C. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.

D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

E. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Smoking is prohibited in all areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Project Acceptance.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Construction Manager. Owner reserves right to take possession of Project identification signs.
   2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include the following:
   1. Division 01 Section "Allowances" for products selected under an allowance.
   2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   3. Divisions 02 through 28 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.03 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.04 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
   1. Coordinate product list with Construction Manager's Construction Schedule and the Submittals Schedule.
   2. Form: Tabulate information for each product under the following column headings:
      a. Specification Section number and title.
      b. Generic name used in the Contract Documents.
      c. Proprietary name, model number, and similar designations.
      d. Manufacturer's name and address.
      e. Supplier's name and address.
      f. Installer's name and address.

g. Projected delivery date or time span of delivery period.
h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 14 days after date of commencement of the Work, submit one electronic copy of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
   a. At Construction Manager's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
4. Completed List: Within 30 days after date of commencement of the Work, submit one copy of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Construction Manager within 10 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests After Award of Contract (If Allowed by the Architect): Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Substitution Request Form: Use sample form approved by the Architect.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
      a. Statement indicating why specified material or product cannot be provided.
      b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
      d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
      e. Samples, where applicable or requested.
      f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
      g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
      h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
      i. Detailed comparison of Construction Manager's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
      j. Cost information, including a proposal of change, if any, in the Contract Sum.
      k. Construction Manager's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
      l. Construction Manager's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Construction Manager of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    a. Form of Acceptance: Change Order.
    b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
    b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.05 QUALITY ASSURANCE

A. Compatibility of Options: If Construction Manager is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
1. Each subcontractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between subcontractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.07 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Construction Manager of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
   3. Refer to Divisions 02 through 28 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
   6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:
   1. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
   2. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.

3. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
4. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
5. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
6. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.02 PRODUCT SUBSTITUTIONS

A. Conditions: Architect will consider Construction Manager's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    2. Requested substitution does not require extensive revisions to the Contract Documents.
    3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    4. Substitution request is fully documented and properly submitted.
    5. Requested substitution will not adversely affect Construction Manager's Construction Schedule.
    6. Requested substitution has received necessary approvals of authorities having jurisdiction.
    7. Requested substitution is compatible with other portions of the Work.
    8. Requested substitution has been coordinated with other portions of the Work.
    9. Requested substitution provides specified warranty.

2.03 COMPARABLE PRODUCTS

A. Conditions: Architect will consider Construction Manager's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.

B. Related Requirements:
   1. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
   2. Section 07 84 13 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.02 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Certified Surveys: Submit two copies signed by land surveyor.

D. Final Property Survey: Submit five copies showing the Work performed and record survey data.

1.03 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
   2. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
      a. Water, moisture, or vapor barriers.
      b. Membranes and flashings.
      c. Sprayed fire-resistive material.
      d. Equipment supports.
      e. Piping, ductwork, vessels, and equipment.

3. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.03 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish limits on use of Project site.
   3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   4. Inform installers of lines and levels to which they must comply.
   5. Check the location, level and plumb, of every major element as the Work progresses.
   6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
   7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.04 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

C. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
   1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
   2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.05 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. Proceed with patching after construction operations requiring cutting are complete.

D. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
   2. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

E. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
   3. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

3.08 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.09 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial Completion procedures.
   2. Final completion procedures.
   3. Warranties.
   4. Final cleaning.
   5. Repair of the Work.

B. Related Requirements:
   1. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
   2. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.02 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.03 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.04 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.05 SUBSTANTIAL COMPLETION PROCEDURES

A. Construction Manager's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Construction Manager's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
   1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
   2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
   3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
5. Submit test/adjust/balance records.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.06 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
   1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.07 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.
   1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
   2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
   3. Include the following information at the top of each page:
      a. Project name.
      b. Date.
      c. Name of Architect.
      d. Name of Construction Manager.
      e. Page number.
   4. Submit list of incomplete items in the following format:
      a. PDF electronic file. Architect will return annotated file.

B. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

C. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

D. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
   1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
   2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
   3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
   4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    k. Remove labels that are not permanent.
    l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    p. Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
    q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    r. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

3.02 REPAIR OF THE WORK

A. Complete repair operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
   1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
   2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
      a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
   3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
   4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

B. Related Requirements:
   1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.02 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
   2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:
   1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 15 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
   1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 10 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.02 REQUIREMENTS FOR OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
   1. Title page.
   2. Table of contents.
   3. Manual contents.

B. Title Page: Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name and contact information for Construction Manager.
   6. Name and contact information for Architect.
   7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
   8. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
   1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
   1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
   2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
   1. Binders: Heavy-duty, three-ring, vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
   a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
   b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.03 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   2. Performance and design criteria if Contractor has delegated design responsibility.
   3. Operating standards.
   4. Operating procedures.
   5. Operating logs.
   6. Wiring diagrams.
   7. Control diagrams.
   8. Piped system diagrams.
   9. Precautions against improper use.
   10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
   1. Product name and model number. Use designations for products indicated on Contract Documents.
   2. Manufacturer's name.
   3. Equipment identification with serial number of each component.
   4. Equipment function.
   5. Operating characteristics.
   6. Limiting conditions.
   7. Performance curves.
   8. Engineering data and tests.
   9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
   1. Startup procedures.
   2. Equipment or system break-in procedures.
   3. Routine and normal operating instructions.
   4. Regulation and control procedures.
   5. Instructions on stopping.

6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.04 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.05 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.01 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Requirements:
   1. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
   2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit copies of record Drawings as follows:
      a. Final Submittal:
         1) Submit PDF electronic files of scanned record prints and one set of prints.
         2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and annotated PDF electronic files and directories of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

PART 2 - PRODUCTS

2.01 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding archive photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations below first floor.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.

g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Work Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
2. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
a. See Section 01 33 00 "Submittal Procedures" for requirements related to use of Architect's digital data files.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Identification: As follows:
a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

2.02 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.

B. Format: Submit record Specifications as scanned PDF electronic file of marked-up paper copy of Specifications.

2.03 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders[, record Specifications,] and record Drawings where applicable.

B. Format: Submit record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
   1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

PART 3 - EXECUTION

3.01 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

1.02 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.03 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
   1. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name of Architect.
      c. Name of Construction Manager.
      d. Date of video recording.
   2. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.
2. Documentation: Review the following items in detail:
    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.
    f. Safety procedures.
    g. Instructions on stopping.
    h. Normal shutdown instructions.
    i. Operating procedures for emergencies.
    j. Operating procedures for system, subsystem, or equipment failure.
    k. Seasonal and weekend operating instructions.
    l. Required sequences for electric or electronic systems.
    m. Special operating instructions and procedures.
5. Adjustments: Include the following:
    a. Alignments.
    b. Checking adjustments.
    c. Noise and vibration adjustments.
    d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
    a. Diagnostic instructions.
    b. Test and inspection procedures.
7. Maintenance: Include the following:
    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.
8. Repairs: Include the following:
    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

3.02 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location. Training to occur at Architect/ Engineer Substantial Completion site visit.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
    1. Architect/ Engineer can furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
    2. Owner will furnish an instructor to describe Owner's operational philosophy.
    3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
    1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION

SECTION 03 05 10

SODIUM SILICATE FREE CONCRETE ENHANCEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:
   1. A high-performance concrete enhancement technology known as a Porosity Inhibiting Admixture (PIA) for all new concrete, including slab-on ground, elevated slabs, structural roof decks, stair treads and landings. PIA's may be utilized exteriorly on tilt-up wall assemblies, retaining walls, swimming pools, parget and elevator pit components. PIA technology enhances concrete performance with low water/cement (W/C) ratio mix designs found in high rise projects

B. Related Sections:
   1. Division 03 Section "Cast-in-Place Concrete" for ASTM 1745 vapor retarders.
   2. Division 07 Waterproofing Sections - for horizontal & vertical concrete and roofing applications in which waterproofing is to be applied
   3. Division 09 Flooring Sections for all moisture sensitive flooring materials installed over concrete slabs with "PIA" technology for flooring applications involving both standard preparation and installation requirements. Flooring manufacturers may require additional slab prep to substrate surfaces that have curing compounds or sealers applied or on slabs that have been power troweled. Power troweling concrete may create nonporous substrate conditions as defined by the flooring industry. The appropriate preparation, use, application and installation of nonporous adhesives may be required by flooring industry slab preparation guidelines.

1.02 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.

1.03 REFERENCES

A. Industry Guidelines:
   1. American Concrete Institute (ACI):
      a. ACI 306R-10 Guide to Cold Weather Concreting
      b. ACI 305R-10 Guide to Hot Weather Concreting
      c. ACI 302.2R-06 Guide for Concrete Slabs that receive Moisture Sensitive Flooring
      d. ACI 308R-16 Guide to Curing Concrete
      e. ACI 302.1R- 96 Guide for Concrete Floor Slab Construction (Topping Depth)
      f. ACI 503R-93& 98 Use of Epoxy Compounds with Concrete

B. Procedural Testing Methods:
   1. American Society for Testing and Materials International (ASTM)
      a. ASTM D7234-05 Pull Off Adhesion Strength of Coatings on Concrete….
      b. ASTM C 494/C 494M-08a Chemical Admixtures for Concrete Type S.
      c. ASTM C 157/C 157M - 08 Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
      d. ASTM C1202/AASHTO T277: Rapid Chloride Permeability Test
      e. ASTM G 109: Standard Test Method for Determining Effects of Chemical Admixtures on Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
      f. ASTM C 1260: Standard Test Method for Potential Alkali Reactivity of Aggregates
      g. ASTM E 1745: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

h. ASTM E 1643: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
i. ASTM F 710-11 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
j. ASTM D 5084: Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
k. U.S. Army Corp of Engineers CRD-C48-92 Standard Test Method for Permeability of Concrete

1.04 SUBMITTALS

A. Product Data: Manufacturer's printed data.

B. Product test reports performed by a qualified independent testing agency evidencing compliance of products with specified requirements of a porosity inhibiting admixture with a comprehensive past testing library of the product upon request.

C. Sample copy of standard or copyrighted "Life of the Concrete" warranty.

D. Sample copy of standard published adhesion guarantee.

E. Sample copy of standard published moisture letter.

F. HPD Health Product Declaration.

G. Safety Data Sheet. (SDS)

H. Provide copy of USA based insurance coverage to confirm warranty enforcement and legitimacy upon request.

I. Comparison chart to other products if listed in spec with back-up documentation available upon request. Compare your product to others based only upon standard published fact-based literature with regards to specific project utility.

J. National reference list of 2800+ standard "Life of the Concrete" warranted projects; all of which had ASTM 5084 testing performed with documentation of such testing upon request.

K. Provide copy of standard "Field Procedure Checklist" with specific party responsibilities defined and delineated for all field participants for required preconstruction meeting.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm with not less than Ten (10) years' experience in the actual manufacture of a concrete enhancement technology admixture, which can provide qualified independent test reports indicating compliance with specified project performance requirements. Selected product manufacturer must have certification of compliance with ASTM C494 /C494M testing protocols from an independent AASHTO approved laboratory. Compounders or re-packagers of base or stock marketed products manufactured by another manufacturing entity - regardless of that products particular market claim or position will not be accepted. A manufactured product is considered to be a stand-alone source or entity that manufacturers the porosity inhibiting admixture "PIA" and its components primarily in house. Manufacturer must be USA based with a legitimate manufacturing presence in the USA and internationally to assure legitimacy of warranty enforcement. All freight will be shipped by a USA freight carrier with such costs included in the initial product shipment. A manufacturer will provide an on-site, contracted independent ACI certified technical representation for each day's placement capable of sampling a minimum of one random cylinder per day's concrete placement for independent daily ASTM 5084 testing. Manufacturer should be in good standing with the EPA and OSHA regulations in the US or other comparable agencies present in foreign markets.

B. Pre-installation Conference
   1. Verify all parties are familiar with specific “PIA” and Concrete Enhancement Technology for the specific project quality control procedures, review concrete mix designs and examine procedures for ensuring quality of concrete materials. Each entity directly concerned with “PIA” dosed concrete must attend in person, conference call, or provide electronic review of documents, mix designs and procedures. Those required to participate or to review include but are not limited to:
      a. General Contractor
      b. Independent testing agency responsible for PSI testing of concrete design mixtures, sampling and testing.
      c. Ready-mix concrete manufacturer.
      d. Concrete subcontractor
      e. Porosity Inhibiting Admixture (PIA) manufacturer.
      f. Moisture Vapor Reduction Admixture distributor.

C. Ready Mixed Concrete 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."

D. Porosity Inhibiting Admixture Collection Agent / Representative Qualifications
   1. Personnel conducting field sampling on behalf of the PIA manufacturer shall be qualified as a ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   2. Daily sample collections conducted by those uncertified through ACI are not considered valid.

E. Slab Moisture Testing and Evaluation: Personnel performing laboratory tests shall be certified in the conduct of ASTM D5084 and Army Corp of Engineers CRD C48-92 under the supervision of a licensed geotechnical engineer. The determination as to whether the concrete slab is prepared to receive flooring, coatings, roofing, etc. rests with the “PIA” distributor in conjunction with adherence and compliance with typical manufacture’s installation guidelines.

F. Source Limitations: Obtain Porosity Inhibiting Admixture “PIA” from the same manufacturer / distributor.

G. ACI Publications: For slabs to receive moisture sensitive coatings or material, comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 302.2R-06, "Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring".
   2. ACI 308-16 “Guide to External Curing of Concrete” Ref. Section 4.1.4 “Moisture Sensitive Floors”

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver “PIA” in distributor’s original, undamaged containers.

B. Store “PIA” protected from exposure to harmful weather conditions and in a temperature controlled area above 36 degrees.

C. Do not allow product to freeze. Should product freeze, immediately contact the “PIA” manufacturer for further instructions.

1.07 WARRANTY

A. Porosity Inhibiting Admixture (“PIA”):
   1. “PIA” must be installed according to, and in compliance with, the distributor’s published data sheet to include, but not limited to:
      a. Dosing instructions.
      b. Onsite independent representation and sampling requirements.

c. Use of an ASTM E 1745 vapor retarder installed following ASTM E 1643 and ACI 303.2R -06 and ASTM F710 guidelines; elevated slabs to receive flooring do not require a vapor retarder.
d. The design and specifications for roof deck assemblies, to include but not limited to, the use of air barriers and/or vapor retarders is the sole responsibility of the design professional and is excluded from this warranty as are any costs incurred due to roofing overburden.
e. Curing for all moisture sensitive products should be in compliance with ACI 308-16 “Guide to External Curing of Concrete” Section 4.1.4 “Moisture Sensitive Floors”

2. Manufacturer's Standard Warranty: To include:
   a. Term: Life of the Concrete Warranty.
   b. Repair and/or removal of failed flooring or roofing.
   c. Placement of a topical moisture remediation system.
   d. Replacement of flooring/roofing materials like original installed to include material and labor.
   e. Sodium Silicate Free Concrete Enhancement Technology (CET) known as a Porosity Inhibiting Admixture “PIA”
3. Adhesion Warranty: “PIA” Manufacturer shall provide a standard adhesion warranty to match the term of the adhesive and/or primer manufacturer's material defect warranty upon “PIA” manufacturer’s acceptance of field adhesive bond testing which followed flooring / adhesive manufacturer guidelines and requirements noted in ASTM F-710 for installation on a nonporous surface.
4. Moisture Letter: “PIA” Manufacturer shall provide a standard moisture letter indicating warrantability up to 100% RH per qualified ASTM 2170 Insitu Probe testing and up 25lbs for ASTM 1869 CaCl testing.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design “Barrier One Admixture” as distributed by Concrete Moisture Solutions “CMS”; 640 Garden Commerce Parkway, Winter Garden, Florida 34787. Phone: 877.224.5850 Fax: 866 594 3490. Email: info@barrierone.com <mailto:info@barrierone.com>

B. Other Acceptable Manufacturers:
   1. Koster Vap I
   2. Mapei EMB
   3. Ardex MC Plus System
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Concrete porosity inhibiting admixture “PIA” for all interior slabs (on ground and elevated) and structural roof deck construction shall be a non-toxic, liquid admixture that is free of all volatile organic compounds (VOC) and sodium silicate class materials or properties. It shall be specifically designed to have a natural chemical reaction with pre-existing elements inside the concrete to eliminate the route of moisture vapor emission through the slab by restricting the integral capillary system. This concrete enhancement technology shall create a natural chemical reaction forming a permanent barrier (capillary break) that is integral to the concrete, insoluble, and irremovable.
   1. Hydraulic conductivity: Project specific maximum of 6.0 E-8 cm/s per ASTM D5084 as tested daily
   2. Toxicity: None
   3. Odor: None
   4. Flammability: None
   5. VOC levels: zero
   6. Solvent: water
   7. Freeze Temp: 32 degrees Fahrenheit (00 C) (store above 360 F (2.30 C))

8. Acid resistance: Excellent
9. Hazardous vapors: None
10. Installation: All concrete
11. Capillary break: Calcium Silicate Hydrate
12. pH: 11.3
13. weight: 10.3 lbs/gal (net)
14. Integral biocide to inhibit growth of mold and bacteria
15. Reactive Silicates: Contains no sodium silicate

2.03 RELATED MATERIALS

A. Sheet Vapor Retarder: ASTM E 1745 compliant material, with a maximum permeance of 0.1 US Perms and a minimum thickness of 0.01". Include manufacturer's recommended adhesive or pressure-sensitive tape, foundation and penetration detailing per both ASTM 1643 and manufacturer's detailing and installation and application instruction.
   1. Products: Subject to compliance with requirements, [available products that may be incorporated into the Work may be manufactured by, but are not limited to, the following]:
      a. Perminator, Inc.
      b. Meadows, W. R., Inc.
      c. Raven Industries Inc.
      d. Reef Industries, Inc.
      e. Stego
   2. It is the responsibility of the vapor retarder manufacturer to show compliance with the most current version of ASTM E1745.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with the requirements of Division 03 Cast-in-Place Concrete, or other appropriate section, for concrete mixing, placing and curing. Noted specifically in ACI 302.2R-06 and ACI 308-16 as well as ASTM F-710 requirements for moisture sensitive flooring.

B. Sheet Vapor Retarders: Place, protect, and repair ASTM 1745 sheet vapor retarders according to ASTM E 1643 and specific manufacturer's written repair and replacement instructions.

C. Add "PIA" in accordance with manufacturer's printed data sheet instructions: For mix designs ranging from 0.31 to 0.52 w/cm, dosages at 14 ounces per 100 pounds (414ml/45kg) of total cementitious materials. Remove an equal amount of water from the mix. Add separately from other admixtures at the tail end of the load. Mix designs below 0.31 and above 0.52 may require adjustment and consultation with "PIA" manufacturer and is required prior to their use.
   1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete with "PIA" according to ASTM C 94/C 94M; furnish batch ticket information showing dosage of "PIA".
   2. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Add the "PIA" to where it makes direct contact with the ready-mix material and then rotate drum of batch truck on high for at least seven minutes prior to discharge.

D. Freshening onsite with held back mix water is acceptable so long as the practice is in accordance with published ACI guidelines and does not exceed the original water to cementitious material ratio or instructions of the structural engineer and those reviewed by the "PIA: manufacturer.

E. Use of water reducing admixtures is recommended to achieve slumps greater than 4" (102mm).

F. Use of other admixtures in the same batch as "PIA" is acceptable so long as each admixture is added separately.

G. Typical National Ready Mix delivered pricing for Barrier One is in the range of $45 - $60 per cubic yard dependent upon the mix design approved and utilized. Anticipated Bid prices should be reflective of these national averages.

H. The inclusion of a shrink reducing admixture (SRA) is not acceptable

I. In Cold-Weather Placement: Comply with ACI 306.1.

J. In Hot-Weather Placement: Comply with ACI 305.

3.02 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 305 for hot-weather protection during curing. Also consult ACI 308-16 Section 4.1.4 and ACI 302.2 R regarding "Moisture Sensitive Floors"

B. Cure concrete slabs to receive moisture sensitive coatings according to ACI 302.2R-06, by one or a combination of the following methods:
   1. 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 (300 mm), and sealed by waterproof tape or adhesive. Cure concrete containing "PIA" for not less than 24 hours, longer if ambient conditions are hot, windy, and sunny or subject to periods of very low humidity. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   2. 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. 1. Removal: After curing period has elapsed, mechanically remove curing compound prior to the installation of final flooring material in accordance with ASTM F-710.
      b. 2. Do not chemically remove.

3.03 FIELD QUALITY CONTROL

A. Testing and Inspecting: The manufacturer of the porosity inhibiting admixture "PIA" will, at their expense, contract with a qualified independent agency to obtain project specific sample cylinders and independent certified laboratories for subsequent testing per ASTM D5084 and preparation of test reports per each daily concrete placement.

B. Testing of Slabs Containing "PIA":
   1. The porosity inhibiting admixture "PIA" manufacturer will perform all daily concrete placement internal moisture ASTM 5084 testing in accordance with this specification and will issue project specific standard literature "Life of the Concrete" warranties and adhesion guarantees prior to installation of any slab finishes when requested; no further field slab moisture nor pH testing shall be required.
      a. Failure to provide a product that meets or exceeds these requirements will result in all subsequent testing and slab remediation costs being borne by the concrete contractor and GC.
   2. A contracted independent and certified agency of the porosity inhibiting admixture "PIA" manufacturer's choice must be present at the jobsite during placement of all "PIA" treated concrete.
      a. Do not proceed without this contracted, qualified representative being present.
      b. A minimum of one business day notification is required.
   3. Field testing technician shall, at the expense of the "PIA" Manufacturer, procure at least one 4x8 inch (102 mm) cylinder from a random project placement of "PIA" dosed concrete for subsequent hydraulic conductivity/coefficient of permeability testing.
   4. All cylinders shall be independently lab tested in accordance with ASTM D 5084 and/or Army Corp of Engineers CRD C48-92 at the expense of the "PIA" manufacturer.
   5. Test results must conform to specified limits.
      a. Should any cylinder from any day of placement deliver results more than 6.0 E-08 cm/sec, the concrete porosity inhibiting admixture manufacturer shall procure, at their expense, a core (or cores) from that day's placement. This core (cores) shall be sent to an independent laboratory for hydraulic conductivity testing (coefficient or permeability) per ASTM D 5084.

b. Should any core deliver results more than 6.0 E-08 cm/sec per ASTM D 5084, the concrete porosity inhibiting admixture manufacturer shall provide, at their expense, a topical moisture mitigation system for the tested areas not meeting the stated limit provided dosing and field process protocol was followed.

6. Proceeding with any concrete placement dosed with the “PIA” and without the required representation will result in the contractor bearing the cost to core and ship appropriate material for testing per ASTM D 5084 and the possible subsequent remediation expenses.

3.04 REPAIRS

A. Make concrete repairs to slab in accordance with Division 03 Section “Cast-in-Place Concrete”.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
   1. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.
   2. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.04 PREINSTALLATION MEETINGS

A. 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 special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

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.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form materials and form-release agents.
   4. Steel reinforcement and accessories.
   5. Curing compounds.
   6. Floor and slab treatments.
   7. Bonding agents.
   8. Adhesives.
   9. Vapor retarders.
   10. Joint-filler strips.
   11. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:
   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.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
   1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
   1. 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.
   2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

1.08 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.10 FIELD CONDITIONS

A. 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.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, 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.

PART 2 - PRODUCTS

2.01 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
   1. ACI 301.
   2. ACI 117.

2.02 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
      c. Structural 1, B-B or better; mill oiled and edge sealed.
      d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
   3. Overlaid Finnish birch plywood.

B. 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.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

G. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

H. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.03 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 1064/A 1064M, [as drawn] [galvanized].

C. Deformed-Steel Wire: ASTM A 1064/A 1064M.

D. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

E. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

2.04 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
   1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.05 CONCRETE MATERIALS

A. 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.

B. Cementitious Materials:
   1. Portland Cement: ASTM C 150/C 150M, Type I or Type II.
   2. Fly Ash: ASTM C 618, Class F.
   3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
   4. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 1N normal weight 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.

D. Lightweight Aggregate: ASTM C 330/C 330M, 3/4-inch nominal maximum aggregate size.

E. Air-Entraining Admixture: ASTM C 260/C 260M.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do 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.

G. Water: ASTM C 94/C 94M and potable.

2.06 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
      b. Fortifiber Building Systems Group; Moistop Ultra 15.
      c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
      d. Insulation Solutions, Inc.; Viper VaporCheck 16.
      e. Meadows, W. R., Inc.; Perminator 15 mil.
      f. Raven Industries Inc.; Vapor Block 15.
      g. Reef Industries, Inc.; Griffolyn 15 mil Green.
      h. Stego Industries, LLC; Stego Wrap 15 mil Class A.

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.07 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

2.08 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. 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 I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Reglets: Fabricate reglets of not less than 0.022-inch-thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.09 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/C 150M, 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 4,500 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/C 150M, 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 6,000 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. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

C. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. 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.
   3. Slag Cement: 50 percent.
   4. Combined Fly Ash or Pozzolan and Slag Cement: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
   5. Silica Fume: 10 percent.
   6. Combined Fly Ash, Pozzolans, and Silica Fume: 35 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.
   7. Combined Fly Ash or Pozzolans, Slag Cement, and Silica Fume: 50 percent with fly ash or pozzolans not exceeding 25 percent and silica fume not exceeding 10 percent.

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 parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings & Foundation Walls: Normal-weight concrete.
   1. Minimum Compressive Strength: As indicated at 28 days.
   2. Maximum W/C Ratio: 0.45.
   3. Slump Limit: 5 inches, plus or minus 1 inch.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Slabs-on-Grade: Normal-weight concrete.
   1. Minimum Compressive Strength: As Indicated at 28 days.
   2. Maximum W/C Ratio: 0.45.
   3. Slump Limit: 5 inches, plus or minus 1 inch.
   4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Suspended Slabs: Normal-weight concrete.
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Maximum W/C Ratio: 0.45.
   3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
   4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

D. Suspended Slabs: Lightweight concrete.
   1. Minimum Compressive Strength: 4000 psi at 28 days.
   2. Calculated Equilibrium Unit Weight: 115 lb/cu. ft., plus or minus 3 lb/cu. ft. as determined by ASTM C 567/C 567M.
   3. Slump Limit: 5 inches or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
   4. 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 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

3.01 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch] for smooth-formed finished surfaces exposed to view.
   2. Class C, 1/2 inchfor rough-formed finished surfaces not exposed to view.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.02 EMBEDDED ITEM INSTALLATION

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 303.
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.03 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.04 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.05 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting 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 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.

3.06 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. 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 does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
      a. Comply with the Soff-Cut International, Inc.’s instruction for the SOFF-CUT System.
         1) Hand-troweled, burnished finish: Install cuts 0 to 2 hours after final finish at each joint location.
         2) Broom, burlap finish: Install cuts at each control joint location as soon as concrete will support weight of saw and operator without disturbing final finish.
         3) Cut depth not less than 10 percent of slab thickness with a 1-inch minimum.
         4) Remove debris in path of cut and under Skid Plate before cutting. Skid Plate must remain flat on surface.
         5) Use SOFF-CUT blades and Skid Plates, using a new Skid Plate with each new blade.
         6) Install SOFF-CUT joint protector at saw-cut intersection prior to cross-cut.

7) Remove dry powder without disturbing finish.
8) Avoid traffic across saw cut until sufficient strength is gained to protect joint edges.

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.

3.07 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

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 is 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 not to 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. Maintain
2. reinforcement in position on chairs during concrete placement. Screed slab
3. surfaces with a straightedge and strike off to correct elevations. Slope
4. 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.

3.08 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:
   1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
   2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
   3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.09 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. Do not “slick” finish slabs, which prohibits optimum vapor transmission after the curing period.

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 concrete floor toppings or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces indicated to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system
   2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated and where ceramic or quarry tile is to be installed by either thickset or thinset 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.

G. Slip-Resistive Finish: Before final floating, apply slip-resistive finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive silica aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
2. After broadcasting and tamping, apply float finish.
3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.10 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete (housekeeping pad) bases as indicated high unless otherwise indicated and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi at 28 days.
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 substrate.
6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305.1 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 remainder of 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.

3.12 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 (1) 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 joints clean and dry.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 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 matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.

3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Agency: 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/C 172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C 143; 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.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. 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.

7. Compression Test Specimens: ASTM C 31.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. 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.
11. 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.
12. 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.
13. 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.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. 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 24 hours of finishing.

END OF SECTION

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Face brick.
   3. Mortar and grout.
   4. Masonry joint reinforcement.
   5. Ties and anchors.
   6. Embedded flashing.
   7. Miscellaneous masonry accessories.

B. Related Sections:
   1. Section 01 21 00 "Allowances" for brick masonry allowance.
   2. Section 05 12 00 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
   3. Section 05 50 00 "Metal Fabrications" for furnishing steel lintels and shelf angles for unit masonry.
   4. Section 07 21 00 "Thermal Insulation" for furnishing cavity wall insulation installed in accordance with this section.
   5. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.02 REFERENCE STANDARDS

A. ACI 530/ASCE 5/TMS 402 - Building Code Requirements for Masonry Structures; American Concrete Institute International.

B. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International.

C. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

D. ASTM A 641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire (Metric).

E. ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.

F. ASTM C 90 - Standard Specification for Loadbearing Concrete Masonry Units.

G. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete.

H. ASTM C 140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units.

I. ASTM C 207 - Standard Specification for Hydrated Lime for Masonry Purposes.

J. ASTM C 216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale).

K. ASTM C 476 - Standard Specification for Grout for Masonry.

L. ASTM C 780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

1.03 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.04 PRECONSTRUCTION TESTING

A. Mortar Test (Property Specification): For each mix required, according to ASTM C 780 for compressive strength.

B. Grout Test (Compressive Strength): For each mix required, according to ASTM C 1019.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For the following:
   1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
   2. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:
   1. Face brick, in the form of straps of five or more bricks.
   2. Special brick shapes.
   3. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
   4. Weep holes.
   5. Accessories embedded in masonry.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:
   1. Masonry units.
      a. Include material test reports substantiating compliance with requirements.
      b. For exposed brick, include test report for efflorescence according to ASTM C 67.
      c. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
   4. Grout mixes. Include description of type and proportions of ingredients.
   5. Reinforcing bars.
   6. Joint reinforcement.
   7. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

1.07 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. The work shall be performed by a firm who specializes in masonry construction and shall furnish all materials, equipment, and labor required to complete the work (square foot/unit pricing of masonry labor and Construction Manager furnished materials are not permitted.)

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups for typical exterior wall in sizes approximately 72 inches (1800 mm) long by 72 inches (1800 mm) high by full thickness, including face and backup wythes and accessories.
      a. Include a sealant-filled joint at least 16 inches (400 mm) long in exterior wall mockup.
      b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
      c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
      d. Include metal studs, sheathing, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
   2. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
   3. Protect accepted mockups from the elements with weather-resistant membrane.
   4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
      a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
   5. Locate mockup where directed by the Architect/Owner.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
   2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
   1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide radius corners for outside units.

B. CMUs: ASTM C 90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi for 8 inch walls and 2800 psi for 12 inch walls at mechanical yard and gymnasium. See Structural Drawings.
   2. Density Classification: Normal weight unless otherwise indicated.
   3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

C. Lightweight Concrete Masonry Units (Rated Block Walls):
   1. Lightweight concrete masonry units shall conform to the requirements of ASTM Specification C-90, Type II, for load bearing concrete masonry units. All units shall be free of organic impurities that will cause rusting, staining or pop outs, and shall contain no combustible matter. The use of coal cinder aggregate/bottom ash, or similar waste products will not be allowed.
   2. All aggregate used in the concrete units shall conform to ASTM Specification C 331 "Lightweight Aggregates for Concrete Masonry Units", shall be expanded shale produced by rotary kiln process, and shall be graded to assure constant texture.
      a. CMU units shall comply with 721.3.2 of the North Carolina State Building Code for expanded shale, clay or slate and shall have a minimum thickness of 2.6 inches for 1 hour rated block and 3.6 inches for 2 hour rated block. Ratings for block walls shall be as indicated on the Drawings.
   3. The air dry weights of all units shall not exceed the following:
      a. 4 x 8 x 16 - 16 pounds; 4 x 8 x 16 - 75% solid - 22 pounds
      b. 6 x 8 x 16 - 20 pounds; 6 x 8 x 16 - 75% solid - 29 pounds
      c. 8 x 8 x 16 - 26 pounds; 8 x 8 x 16 - 75% solid - 38 pounds
      d. 12 x 8 x 16 - 37 pounds; 12 x 8 x 16 - 75% solid - 56 pounds
   4. All 8 inch or larger units shall meet U.L. U905 requirements for two hours or better rating (as required) and certificates shall be furnished to the architect prior to any concrete masonry work.
   5. The producer of the concrete masonry units will furnish a letter of certification stating that all aggregate used in the manufacturer of the units was expanded and produced by rotary kiln process, conforming to ASTM C 331.

D. Split Face Concrete Block: Provide normal weight concrete units with integral water repellent treatment.
   1. Block shall be in accordance with ASTM C90, Grade N, Type II.
   2. Size: Manufacturer's standard with nominal face dimensions of 16 inches long x 8 inches high (15-5/8 inches x 7-5/8 inches actual), 4 inches x 8 inches, 4 inches x 16 inches and scored face units 8 inches x 16 inches x thickness indicated.
   3. Colors: Provide two colors of range to be selected, standard or custom colors.
   4. Comply with requirements of ASTM C90 and C140.
   5. Minimum average net area compressive strength shall be 1900 psi.
   6. Customized masonry, having a split face shall be manufactured with a chamfered edge on each side of the split area to ensure a controlled straight break on the face shell of the unit.
   7. Manufacturers: Adams Concrete, Johnson Concrete Company, Metromont or approved equal.
   8. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MASONRY LINTELS

A. Provide prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.04 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.

3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.
1. Grade: SW.
2. Type: FBS.
3. Initial Rate of Absorption: Less than 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67.
4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
5. Size (Actual Dimensions): 3-1/2 to 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long..
6. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.
7. Application: Use where brick is exposed unless otherwise indicated.
8. Where cores or frogs would be exposed in finish work, in pierced masonry and elsewhere, brick shall be without cores and frogs.

2.05 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Colored Cement Product (Brick Veneer Mortar): Packaged blend made from portland cement and hydrated lime and mortar pigments, all complying with specified requirements, and containing no other ingredients.
1. Colored Portland Cement-Lime Mix:
a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1) Capital Materials Corporation: Riverton Portland Cement Lime Custom Color.
2) Holcim (US) Inc.: Rainbow Mortamix Custom Color Cement/Lime.
3) Argos; Eaglebond Portland and Lime Type N.
4) Lehigh Cement Company: Lehigh Custom Color Portland/Lime Cement.
2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
3. Pigments shall not exceed 10 percent of portland cement by weight.
4. Mortar Color: SC 394 by Argos.

E. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

2.06 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
   1. Interior Walls: Mill- galvanized, carbon steel.
   2. Exterior Walls: Hot-dip galvanized, carbon steel.
   3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
   4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
   5. Wire Size for Veneer Ties: 0.148-inch (3.77-mm) diameter.
   6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
   7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Multiwythe Masonry:
   1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face. Ties have hooks or clips to engage a continuous horizontal wire in the facing wythe.

2.07 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.

B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch (16-mm) cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches (50 mm) parallel to face of veneer.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.

D. Cavity Wall Reinforcement at Double Wythe Masonry: Reinforcement shall be manufactured from cold-drawn steel wire conforming to ASTM A 82. Eye and pintel shall extend far enough into the cavity through rigid insulation to allow for free movement of tie section. Reinforcement shall be eye & pintel ladder type. Longitudinal wires and tabs shall be 9 x 9 gauge with 3/16 inch ties. Reinforcement and ties shall be hot-dipped galvanized in accordance with ASTM A 153, Class B-2 (1.5 oz./sq. ft.). Provide pre-formed 'T's and corners at wall intersections.
   1. Manufacturers:
      a. Dur-O-Wall Model D/A360.
      b. Hohman & Barnard Model Lox All No. 270.
      c. WIREBOND Series 800.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Adjustable Masonry-Veneer Anchors:
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
   2. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) Heckmann Building Products Inc.
         2) Wire-Bond: RJ-711 (Basis of Design).
         3) Hohmann Bernard.

3. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads.

2.08 MISCELLANEOUS ANCHORS

A. Unit Type Inserts in Concrete: Cast-iron or malleable-iron wedge-type inserts.

B. Anchor Bolts: Headed or L-shaped steel bolts complying with ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153/A 153M, Class C; of dimensions indicated.

2.09 EMBEDDED THROUGH-WALL FLASHING MATERIALS

A. Flexible Flashing: Use the following unless otherwise indicated:
   1. Copper-Laminated Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry. Flashing shall be compatible with air barrier.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) Advanced Building Products Inc.: Copper Fabric Flashing.
         2) Dayton Superior Corporation, Dur-O-Wal Division: Copper Fabric Thru-Wall Flashing.
         3) Hohmann & Barnard, Inc.: & B C-Fab Flashing.
         4) Phoenix Building Products: Type FCC-Fabric Covered Copper.
         5) Sandell Manufacturing Co.: Inc.; Copper Fabric Flashing.
         6) York Manufacturing, Inc:. Multi-Flash 500.

B. Application: Unless otherwise indicated, use the following:
   1. Where flashing is fully concealed, use flexible flashing. Leading edge of flashing shall be left hanging beyond the face of the brick for trimming flush after installation is complete.

C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates. Provide continuous termination bar with sealant along top edge of flashing along sheathing and air barrier.

D. Provide flashing membrane from same manufacturer as air barrier specified in 07 27 26 or provide through-wall flashing compatible with air barriers specified.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

D. Weeps: At all open head joint weeps, provide Model D/A 1006 as manufactured by Dur-O-Wal, Model 3601 as manufactured by WIREBOND or approved equal manufactured by Hohmann & Barnard, Inc.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Advanced Building Products Inc.: Mortar Break.
   b. Archovations, Inc.: CavClear Masonry Mat.
   c. Dayton Superior Corporation, Dur-O-Wal Division: Polytite MortarStop.
   d. Mortar Net USA, Ltd.: Mortar Net.
2. Provide one of the following configurations:
   a. Strips, full-depth of cavity and 10 inches (250 mm) high, with dovetail shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.
   b. Strips, not less than 1-1/2 inches (38 mm) thick and 10 inches (250 mm) high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.

F. Termination Bars: Stainless steel.

G. Sealant: As recommended by flashing manufacturer.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Diedrich Technologies, Inc.
      b. EaCo Chem, Inc.
      c. ProSoCo, Inc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.03 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2 inch (12 mm) maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2 inch (12 mm) maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2 inch (12 mm) maximum.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
   5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

3.04 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond and Flemish bond where indicated; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Install compressible filler in joint between top of partition and underside of structure above.
   2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
   3. Wedge non-load-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
   4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 46 "Fire-Resistive Joint Systems."

3.05 MORTAR BEDDING AND JOINTING

A. Lay hollow brick and CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With webs fully bedded in mortar in all courses of piers, columns, and pilasters.
   3. With webs fully bedded in mortar in grouted masonry, including starting course on footings.
   4. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints with concave profile.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.06 CAVITY WALLS

A. Bond wythes of cavity walls together using one of the following methods:
   1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 4.5 sq. ft. (0.42 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
      a. Where bed joints of wythes do not align, use adjustable (two-piece) type ties.
      b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable (two-piece) type ties to allow for differential movement regardless of whether bed joints align.
   2. Header Bonding: Provide masonry unit headers extending not less than 3 inches (76 mm) into each wythe. Space headers not over 8 inches (203 mm) clear horizontally and 16 inches (406 mm) clear vertically.
   3. Masonry Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity. Keeping the cavity free of mortar droppings is vital to the function of the building envelope system. Excessive mortar droppings will not be tolerated. The Owner and designer reserve the right to require the masonry contractor to utilize mortar sticks to catch and remove mortar droppings as the work progresses.

D. Coat cavity face of backup wythe to comply with Section 07 11 13 "Bituminous Dampproofing."

3.07 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
   1. Space reinforcement not more than 16 inches (406 mm) o.c.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at corners by using prefabricated L-shaped units.

D. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.08 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.09 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
   3. Embed tie sections in masonry joints. Provide not less than 2 inches (50 mm) of air space between back of masonry veneer and face of sheathing.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
   5. Space anchors as indicated, but not more than 18 inches (456 mm) o.c. vertically and 32 inches (813 mm) o.c. horizontally with not less than 1 anchor for each 2.67 sq. ft. (0.25 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 36 inches (914 mm), around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.

3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:
1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches (100 mm) in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 07 92 00 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch (10 mm).
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and through inner wythe to within 1/2 inch (13 mm) of the interior face of wall in exposed masonry. Where interior face of wall is to receive furring or framing, carry flashing completely through inner wythe and turn flashing up approximately 2 inches (50 mm) on interior face.
3. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge terminated using a termination bar, mechanical fasteners and continuous sealant at top of termination bar. Coordinate with air barrier manufacturer's details. Let flashing hang out at face of veneer and cut flush to veneer when work is complete.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.

C. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
   1. Use specified weep/vent products to form weep holes.
   2. Space weep holes formed from plastic tubing 32 inches (800 mm) o.c.
   3. Install weeps at all end dam locations.

D. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches (50 mm), to maintain drainage.
   1. Fill cavities full height by placing pea gravel in cavities as masonry is laid so that at any point masonry does not extend more than 24 inches (600 mm) above top of pea gravel.

E. Place cavity drainage material in cavities above thru-wall flashing and at full thickness of cavity depth.

F. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products to form vents.

3.13 REINFORCED UNIT MASONRY INSTALLATION

A. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

C. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

3.15 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water. Do not exceed 300 psi when using pressure washer for any cleaning process. Use 50 degree fan type spray nozzles at all times when

using pressure washer. Consult brick manufacturer for specific instruction for brick cleaning.

5. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.
6. Clean stone trim to comply with stone supplier's written instructions.

3.16 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

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. Structural steel.
   2. Field-installed shear connectors.
   3. Grout.

B. Related Requirements:
   1. Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
   2. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.
   3. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other steel items not defined as structural steel.
   4. Division 09 for coating requirements.

1.03 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:
   1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
   2. Welded built-up members with plates thicker than 2 inches.
   3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.04 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.06 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment Drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
   5. Identify members and connections of the Seismic-Load-Resisting System.
   6. Indicate locations and dimensions of protected zones.
   7. Identify demand critical welds.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint qualified by testing, including the following:
   1. Power source (constant current or constant voltage).
   2. Electrode manufacturer and trade name, for demand critical welds.

D. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:
   1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
   2. Direct-tension indicators.
   3. Tension-control, high-strength, bolt-nut-washer assemblies.
   4. Shear stud connectors.
   5. Shop primers.
   6. Nonshrink grout.

F. Source quality-control reports.

G. Field quality-control and special inspection reports.

1.08 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).

B. Installer Qualifications: An installer specializing in performing the work of this section with minimum five (5) years of documented experience including involvement in not less than three (3) projects of similar, or greater, size and complexity and maintains a quality control program in accordance with AISC 360, Chapter N.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Comply with applicable provisions of the following specifications and documents:
   1. AISC 303.
   2. AISC 341 and AISC 341s1.
   3. AISC 360.
   4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
   1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
   2. Clean and relubricate bolts and nuts that become dry or rusty before use.
   3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 3125/F 3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
   1. Select and complete connections using schematic details indicated and AISC 360.
   2. Use Allowable Stress Design; data are given at service-load level.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Combined system of moment frame, braced frame, and shear walls.

2.02 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992 or ASTM A 572, Grade 50.

B. Channels, Angles-Shapes: ASTM A 36 or ASTM A 572, Grade 50.

C. Plate and Bar: ASTM A 36 or ASTM A 572, Grade 50.

D. Corrosion-Resisting Structural-Steel Shapes, Plates, and Bars: ASTM A 588, Grade 50.

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B or Grade C, structural tubing.

F. Corrosion-Resisting, Cold-Formed Hollow Structural Sections: ASTM A 847/A 847M, structural tubing.

G. Steel Pipe: ASTM A 53, Type E or Type S, Grade B.
   1. Weight Class: Standard, unless noted otherwise.
   2. Finish: Black except where indicated to be galvanized.

H. Steel Castings: ASTM A 216, Grade WCB with supplementary requirement S11.

I. Steel Forgings: ASTM A 668.

J. Welding Electrodes: Comply with AWS requirements.

2.03 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
   1. Direct-Tension Indicators: ASTM F 959, Type 325-1, compressible-washer type with plain finish.

B. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
   1. Finish: Hot-dip zinc coating.
   2. Direct-Tension Indicators: ASTM F 959, Type 325-1, compressible-washer type with mechanically deposited zinc coating finish.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 3125, Grade F1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
   1. Finish: Plain.

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Unheaded Anchor Rods: ASTM F 1554, Grade 36, unless noted otherwise.
   1. Configuration: Straight.
   2. Nuts: ASTM A 563 heavy-hex carbon steel.
   3. Plate Washers: ASTM A 36 carbon steel.
   4. Washers: ASTM F 436, Type 1, hardened carbon steel.
   5. Finish: Plain.

F. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
   1. Nuts: ASTM A 563 heavy-hex carbon steel.
   2. Plate Washers: ASTM A 36 carbon steel.
   3. Washers: ASTM F 436, Type 1, hardened carbon steel.
   4. Finish: Plain.

G. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

H. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.04 PRIMER

A. Primer: SSPC-Paint 25, Type II, zinc oxide, alkyd, linseed oil primer.

B. Galvanizing Repair Paint: ASTM A 780.

2.05 GROUT

A. Metallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.06 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
   1. Camber structural-steel members where indicated.
   2. Fabricate beams with rolling camber up.
   3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.

4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.

H. Welded Door Frames: Build up welded door frames attached to structural-steel frame. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.07 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.08 SHOP PRIMING

A. Shop prime steel surfaces except the following:
1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.09 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
   1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
   1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect and test shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1and the following inspection procedures, at testing agency's option:
   1. Liquid Penetrant Inspection: ASTM E 165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
   3. Ultrasonic Inspection: ASTM E 164.
   4. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests according to requirements in AWS D1.1 on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates, Bearing Plates and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
   1. Set plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of baseplate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.05 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Verify structural-steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.
   3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Bolted Connections: Inspect and test bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.
   2. Test 10% of all field welds along with weld gage measurement; test 20% of all full and partial penetration welds.

E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

F. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.06 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

SECTION 05 12 13

ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

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 architecturally exposed structural-steel (AESS).
   1. Requirements in Section 05 12 00 "Structural Steel Framing" also apply to AESS.

B. Related Requirements:
   1. Section 05 12 00 "Structural Steel Framing" for additional requirements applicable to AESS.
   2. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications and other metal items not defined as structural steel.
   3. Section 09 91 23 "Interior Painting"

1.03 DEFINITIONS

A. AESS: Structural steel designated as "architecturally exposed structural steel" or "AESS" in the Contract Documents.

B. Category 1 AESS: AESS that is within 96 inches vertically and 36 inches horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 1 architecturally exposed structural steel" or "AESS-1" in the Contract Documents.

C. Category 2 AESS: AESS that is within 20 feet vertically and horizontally of a walking surface and that is visible to a person standing on that walking surface or is designated as "Category 2 architecturally exposed structural steel" or "AESS-2" in the Contract Documents.

D. Category 3 AESS: AESS that is not defined as Category 1 or Category 2 or that is designated as "Category 3 architecturally exposed structural steel" or "AESS-3" in the Contract Documents.

1.04 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.05 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.06 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication of AESS components. Shop Drawings for structural steel may be used for AESS provided items of AESS are specifically identified and requirements below are met for AESS.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment Drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain. Indicate grinding, finish, and profile of welds.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation of bolt heads.
5. Indicate exposed surfaces and edges and surface preparation being used.
6. Indicate special tolerances and erection requirements.

1.07 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer & fabricator.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

1.08 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172).

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

1.09 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling to prevent twisting, warping, nicking, and other damage. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
   1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.10 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 BOLTS, CONNECTORS, AND ANCHORS

A. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 3125/F 3125M, Grade F1852, Type 1, round head assemblies consisting of steel structural bolts with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436/F 436M, Type 1 hardened carbon-steel washers.
   1. Finish: Plain.

2.02 FILLER

A. Filler: Polyester filler intended for use in repairing dents in automobile bodies.

2.03 PRIMER

A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanizing Repair Paint: ASTM A 780.

2.04 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

B. In addition to special care used to handle and fabricate AESS, comply with the following:
   1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, and roughness.
   2. Grind sheared, punched, and flame-cut edges of Category 1 AESS to remove burrs and provide smooth surfaces and edges.
   3. Fabricate Category 1 AESS with exposed surfaces free of mill marks, including rolled trade names and stamped or raised identification.
   4. Fabricate Category 1 and Category 2 AESS with exposed surfaces free of seams to maximum extent possible.
   5. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.
   6. Fabricate with piece marks fully hidden in the completed structure or made with media that permits full removal after erection.
   7. Fabricate Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.
   8. Seal-weld open ends of hollow structural sections with 3/8-inch closure plates for Category 1 AESS.

C. Curved Members: Fabricate indicated members to curved shape by rolling to final shape in fabrication shop.
   1. Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet under any lighting conditions.
   2. Tolerances for walls of hollow steel sections after rolling shall be approximately 1/2 inch.

D. Coping, Blocking, and Joint Gaps: Maintain uniform gaps of 1/8 inch with a tolerance of 1/32 inch for Category 1 AESS.

E. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

F. Cleaning Corrosion-Resisting Structural Steel: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.05 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1 for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work, and comply with the following:
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding specified tolerances.
   2. Use weld sizes, fabrication sequence, and equipment for AESS that limit distortions to allowable tolerances.
   3. Provide continuous, sealed welds at angle to gusset-plate connections and similar locations where Category 1 AESS is exposed to weather.
   4. Provide continuous welds of uniform size and profile where Category 1 AESS is welded.
   5. Grind butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch for Category 1 AESS.

6. Make butt and groove welds flush to adjacent surfaces within tolerance of plus 1/16 inch, minus zero inch for Category 1 AESS. Do not grind unless required for clearances or for fitting other components, or unless directed to correct unacceptable work.
7. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 AESS.
8. At locations where welding on the far side of an exposed connection of Category 1 AESS occurs, grind distortions and marking of the steel to a smooth profile aligned with adjacent material.
9. Make fillet welds for Category 1 AESS oversize and grind to uniform profile with smooth face and transition.
10. Make fillet welds for Category 1 AESS of uniform size and profile with exposed face smooth and slightly concave. Do not grind unless directed to correct unacceptable work.

2.06 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
   2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
   3. Galvanize lintels attached to structural-steel frame and located in exterior walls.

2.07 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials.
   5. Galvanized surfaces.

B. Surface Preparation for Non-galvanized Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."
   3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
   1. If possible, locate welded tabs for attaching temporary bracing and safety cabling where they will be concealed from view in the completed Work.
   2. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.03 ERECTION

A. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
   1. Erect Category 1 AESS to the tolerances specified in AISC 303 for steel that is designated AESS.

B. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

3.04 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.
   2. Orient bolt heads in same direction for each connection and to maximum extent possible in same direction for similar connections.

B. Weld Connections: Comply with requirements in "Weld Connections" Paragraph in "Shop Connections" Article.
   1. Remove backing bars or runoff tabs; back-gouge and grind steel smooth for Category 1 AESS.
   2. Remove erection bolts in Category 1 AESS, fill holes, and grind smooth.
   3. Fill weld access holes in Category 1 AESS and grind smooth.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect AESS as specified in Section 05 12 00 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

3.06 REPAIRS AND PROTECTION

A. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Grind steel smooth.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

D. Touchup Painting: Cleaning and touchup painting are specified in Section 09 91 23 "Interior Painting."

END OF SECTION

SECTION 05 21 00

STEEL JOIST FRAMING

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. K-series steel joists.
   2. KCS-type K-series steel joists.
   3. K-series steel joist substitutes.
   4. LH- and DLH-series long-span steel joists.
   5. Joist girders.
   6. Joist accessories.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for installing bearing plates in concrete.
   2. Section 04 20 00 "Unit Masonry" for installing bearing plates in unit masonry.
   3. Section 05 12 00 "Structural Steel Framing" for field-welded shear connectors.

1.03 DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.04 ACTION SUBMITTALS

A. Product Data: For each type of joist, accessory, and product.

B. Shop Drawings:
   1. Include layout, designation, number, type, location, and spacing of joists.
   2. Include joining and anchorage details; bracing, bridging, and joist accessories; splice and connection locations and details; and attachments to other construction.
   3. Indicate locations and details of bearing plates to be embedded in other construction.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Manufacturer certificates.

D. Mill Certificates: For each type of bolt.

E. Comprehensive engineering analysis of special joists signed and sealed by the qualified professional engineer responsible for its preparation.

F. Field quality-control reports.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."
   1. Manufacturer's responsibilities include providing professional engineering services for designing special joists to comply with performance requirements.

B. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle joists as recommended in SJI's "Specifications."

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.08 SEQUENCING

A. Deliver steel bearing plates to be built into masonry construction.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.
   1. Use ASD; data are given at service-load level.
   2. Design special joists to withstand design loads with live-load deflections no greater than the following:
      a. Floor Joists: Vertical deflection of 1/240 of the span.
      b. Roof Joists: Vertical deflection of 1/360 of the span.

2.02 K-SERIES STEEL JOISTS

A. Manufacture steel joists of type indicated according to "Standard Specification for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members, underslung ends, and parallel top chord.
   1. Joist Type: K-series steel joists and KCS-type K-series steel joists.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Provide holes in chord members for connecting and securing other construction to joists.

D. Top-Chord Extensions: Extend top chords of joists with SJI's Type S top-chord extensions where indicated, complying with SJI's "Specifications."

E. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

F. Camber joists according to SJI's "Specifications."

G. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.03 LONG-SPAN STEEL JOISTS

A. Manufacture steel joists according to "Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series" in SJI's "Specifications," with steel-angle top- and bottom-chord members; of joist type and end and top-chord arrangements as follows:
   1. Joist Type: LH-series steel joists and DLH-series steel joists.
   2. End Arrangement: Underslung.
   3. Top-Chord Arrangement: Parallel.

B. Provide holes in chord members for connecting and securing other construction to joists.

C. Camber long-span steel joists according to SJI's "Specifications."

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.04 JOIST GIRDERS

A. Manufacture joist girders according to "Standard Specification for Joist Girders" in SJI's "Specifications," with steel-angle top- and bottom-chord members; with end and top-chord arrangements as follows:
   1. End Arrangement: Underslung with bottom-chord extensions.
   2. Top-Chord Arrangement: Parallel.

B. Provide holes in chord members for connecting and securing other construction to joist girders.

C. Camber joist girders according to SJI's "Specifications."

D. Equip bearing ends of joists with manufacturer's standard beveled ends or sloped shoes if joist slope exceeds 1/4 inch per 12 inches.

2.05 PRIMERS

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer complying with performance requirements in SSPC-Paint 15, unless noted otherwise in Division 9 specifications.

2.06 JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Bridging: Schematically indicated. Detail and fabricate according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

C. Bridging: Fabricate as indicated and according to SJI's "Specifications." Furnish additional erection bridging if required for stability.

D. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated. Hot-dip zinc coat according to ASTM A 123/A 123M.

E. Steel bearing plates with integral anchorages are specified in Section 055000 "Metal Fabrications."

F. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.
   1. Finish: Plain, uncoated.

G. High-Strength Bolts, Nuts, and Washers: ASTM F 3125, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
   1. Finish: Hot-dipped galvanized.

H. Welding Electrodes: Comply with AWS standards.

I. Galvanizing Repair Paint: ASTM A 780/A 780M.

J. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.07 CLEANING AND SHOP PAINTING

A. Clean and remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories by hand-tool cleaning, SSPC-SP 2 or power-tool cleaning, SSPC-SP 3.

B. Do not prime paint joists and accessories to receive sprayed fire-resistive materials.

C. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

D. Shop priming of joists and joist accessories is specified in Division 09 specifications.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Do not install joists until supporting construction is in place and secured.

B. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written instructions, and requirements in this Section.
   1. Before installation, splice joists delivered to Project site in more than one piece.
   2. Space, adjust, and align joists accurately in location before permanently fastening.
   3. Install temporary bracing and erection bridging, connections, and anchors to ensure that joists are stabilized during construction.
   4. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

C. Field weld joists to supporting steel bearing plates. Coordinate welding sequence and procedure with placement of joists. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

D. Weld joists to supporting steel framework or bolt using carbon-steel bolts.

E. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Visually inspect field welds according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, test field welds according to AWS D1.1/D1.1M and the following procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165/E 165M.
      b. Magnetic Particle Inspection: ASTM E 709.
      c. Ultrasonic Testing: ASTM E 164.
      d. Radiographic Testing: ASTM E 94.

C. Visually inspect bolted connections.

D. Prepare test and inspection reports.

3.04 PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.
   1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2 or power-tool cleaning according to SSPC-SP 3.
   2. Apply a compatible primer of same type as primer used on adjacent surfaces.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

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. Roof deck.
   2. Composite floor deck.
   3. Noncomposite form deck.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for normal-weight and lightweight structural concrete fill over steel deck.
   2. Section 05 12 00 "Structural Steel Framing" for shop- and field-welded shear connectors.
   3. Section 05 50 00 "Metal Fabrications" for framing deck openings with miscellaneous stee shapes.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.
   2. Acoustical roof deck.

D. Evaluation Reports: For steel deck, from ICC-ES.

E. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
   1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.02 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Steel Deck:
      a. ASC Profiles, Inc.
      b. Canam Steel Corp.;The Canam Manac Group.
      c. Consolidated Systems, Inc.
      d. DACS, Inc.
      e. Epic Metals Corporation.
      f. Marlyn Steel Decks, Inc.
      g. New Millennium Building Systems, LLC.
      h. Nucor Corp.; Vulcraft Division.
      i. Roof Deck, Inc.
      j. United Steel Deck, Inc.
      k. Valley Joist; Division of EBSCO Industries, Inc.
      l. Verco Manufacturing Co.
      m. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
   1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G90 zinc coating.
   2. Deck Profile: As indicated.
   3. Profile Depth: As indicated.
   4. Design Uncoated-Steel Thickness: As indicated.
   5. Span Condition: Triple span or more.
   6. Side Laps: Overlapped.

2.03 COMPOSITE FLOOR DECK

A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and Commentary for Composite Steel Floor Deck," in SDI Publication No. 30, with the minimum section properties indicated, and with the following:
   1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G90zinc coating.
   2. Profile Depth: As indicated.
   3. Design Uncoated-Steel Thickness: As indicated.
   4. Span Condition: Double span or more.

2.04 NONCOMPOSITE FORM DECK

A. Noncomposite Form Deck: Fabricate ribbed-steel sheet noncomposite form-deck panels to comply with "SDI Specifications and Commentary for Noncomposite Steel Form Deck," in SDI Publication No. 31, with the minimum section properties indicated, and with the following:
   1. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 40, G90zinc coating.
   2. Profile Depth: As indicated.

3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: Double span or more.

2.05 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.

I. Galvanizing Repair Paint: ASTM A 780.

J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine supporting frame and field conditions 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 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
   1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.03 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Mechanically fasten with Hilti X-HSN 24 powder actuated fasteners installed in compliance with ICC ESR 2197 or equivalent by other manufacturers, based on base steel thickness less than ¼".
   2. Each sheet shall be fastened to each support at each edge and interior ribs of deck units and across the width of the sheet at intervals not exceeding patterns as shown on the drawings.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-third of the span or 16 inches, unless noted otherwise, and as follows:
   1. Mechanically fasten with self-drilling, No. 12 diameter or larger, carbon-steel screws.
   2. Or mechanically fasten with HILTI S-SLC-01 M HWH or HILTI S-SLC-2 M HWH screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped 2 inches minimum.

D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.04 FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members by mechanical fasteners as follows:
   1. Mechanically fasten with Hilti X-HSN 24 powder actuated fasteners installed in compliance with ICC ESR 2197 or equivalent by other manufacturers, based on base steel thickness.
   2. Each sheet shall have edge ribs of panels fastened to each support and additional fasteners not less than a 36/4 pattern as a minimum.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 24 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 12 diameter or larger, carbon-steel screws.
   2. Or mechanically fasten with HILTI S-SLC-01 M HWH or HILTI S-SLC-2 M HWH screws.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Lapped.

D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated.

E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

3.06 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Non-load bearing formed steel stud exterior wall framing.

B. Non-load bearing formed steel stud interior wall framing.

C. Soffit framing.

D. Exterior wall sheathing.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation for insulation on exterior of steel studs.

B. Section 07 21 19 - Foamed-In Place Insulation at CMU cavity walls.

C. Section 055000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.

1.03 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2012

B. AISI S200-12 - North American Specification for the Design of Cold-Formed Steel Framing – General Provisions; 2012

C. AISI S21 -07 w/ S1-12 (2012): North American Standard for Cold-Formed Steel Framing - Wall Stud Design, 2007 Edition With Supplement 1 (Reaffirmed 2012)

D. AISI S212-07 (2012): North American Standard for Cold-Formed Steel Framing – Header Design, 2007 Edition (Reaffirmed 2012)

E. AISI S213-07 w/ S1-09 (2012): North American Standard for Cold-Formed Steel Framing – Lateral Design, 2007 Edition With Supplement 1 (Reaffirmed 2012)

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2012.

D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2013b.

E. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2013c.

F. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.

H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.04 SUBMITTALS

A. Shop Drawings: Indicate component details, framed openings, and accessories or items required of related work.

1. Indicate stud layout. Shop drawings shall include an erection plan, and wall sections coordinated with the Architectural Contract Drawings along with anchorage and connection details for all light gauge steel framing shown on the Contract Drawings.
2. Describe method for securing studs to tracks and for bolted framing connections. All connections shall be clearly detailed on the shop drawings.
3. Provide structural calculations for loadings, analysis and design of specially fabricated framing that have been stamped by a Professional Structural Engineer licensed in the State of North Carolina. Structural calculations shall be for all light gage cold formed framing members including studs for brick veneer, lintels at head of all openings, sills, jambs, tracks and all connections of members. Connection details to structural steel framing shall allow for deflection of structural steel framing.

B. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

C. Delegated-Design Submittal: For cold-formed steel framing.

D. Calculations and shop drawings must be approved in writing by the Architect before work can begin.

1.05 INFORMATIONAL SUBMITTALS

A. Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 014000 "Quality Requirements" and as may be supplemented in "Quality Assurance" Article.

B. Qualification Data: For testing agency.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Evaluation Reports: For nonstandard cold-formed steel framing and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.06 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice and registered in the state of North Carolina and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

D. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

E. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association, or the Steel Stud Manufacturers Association.

F. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
   1. ClarkDietrich Building Systems: www.clarkdietrich.com.
   2. MarinoWare; a Division of Ware Industries: www.marinoware.com.
   3. The Steel Network, Inc: www.SteelNetwork.com.

B. Framing Connectors and Accessories:
   1. Same manufacturer as metal framing.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Interior Non-Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
      b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 (lower wall studs) and 1/240 (2nd floor wall studs) of the wall height.
   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 3/4 inch.
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Design Criteria: Provide completed framing system having the following characteristics:

1. Design: Calculate structural characteristics of cold-formed steel framing members according to AISI North American Specification for the Design of Cold-Formed Steel Structural Members.
2. Structural Performance: Design, engineer, fabricate, and erect to withstand specified design loads for project conditions within required limits.
3. Design Loads: In accordance with applicable codes.
4. Live load deflection meeting the following, unless otherwise indicated:
5. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
6. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 FRAMING MATERIALS

A. Studs and Track: ASTM A1003, Structural Grade, Type H, metallic coated studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and depth: As required to meet specified structural performance levels.
   2. Galvanized in accordance with ASTM A653/A653M and ASTM A1003/A1003M G90/Z275 coating.

B. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M, Grade 50, Class 1 or 2 and ASTM A1003/A1003M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for thicknesses less than 10 gage (0.118 inch) (3 mm), and factory punched holes and slots as required by structural performance.
   2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members.
   3. Movement Connections: Provide mechanical anchorage devices (vertical deflection clips) that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
      a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).
      b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).
   4. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.04 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch.
   2. Flange Width: 2 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0677 inch.
   2. Flange Width: 1-1/2 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   Dietrich Metal Framing; a Worthington Industries Company.
   a. ClarkDietrich Building Systems: www.clarkdietrich.com.
   b. MarinoWare; a Division of Ware Industries: www.marinoware.com.
   c. The Steel Network, Inc: www.SteelNetwork.com.

2.05 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch.
   2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel studs..
   2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass and head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ClarkDietrich Building Systems: www.clarkdietrich.com.
      b. MarinoWare; a Division of Ware Industries: www.marinoware.com.
      c. The Steel Network, Inc: www.SteelNetwork.com.

2.06 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0329 inch.
   2. Flange Width: 1-5/8 inches, minimum.

2.07 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
   1. Supplementary framing.
   2. Bracing, bridging, and solid blocking.
   3. Web stiffeners.
   4. Anchor clips. End
   5. clips. Foundation
   6. clips. Gusset
   7. plates.
   8. Stud kickers and knee braces.
   9. Joist hangers and end closures.
   10. Hole-reinforcing plates.
   11. Backer plates.

2.08 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153, Class C.

C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
   1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

2.09 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 WALL SHEATHING

A. Gypsum Sheathing Board:
   1. Application: Exterior sheathing, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
   3. Glass-Mat-Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C 1177/C 1177M.
   4. Core Type: Regular.
   5. Regular Board Thickness: 5/8 inch (16 mm).
   6. Edges: Square, for vertical application.
   7. Glass-Mat-Faced Products:
      a. CertainTeed Corporation; GlasRoc Brand.
      b. Georgia-Pacific Gypsum LLC; DensGlass Gold Sheathing.
      c. National Gypsum Company; Gold Bond Brand e2XP Extended Exposure Sheathing.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.11 ACCESSORIES

A. Bracing, Furring, Bridging Anchor Ledges and Angles: Formed sheet steel and anchorages, thickness determined for conditions encountered; finish to match framing components.

B. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.12 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
   1. Fabricate framing assemblies using jigs or templates.
   2. Cut framing members by sawing or shearing; do not torch cut.
   3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

C. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.03 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Include details on Drawings showing expansion-joint construction and locations.

H. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

I. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

J. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.04 EXTERIOR & INTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks, sized to match studs. Align floor and ceiling tracks with wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) oc. Coordinate installation of sealant with floor and ceiling tracks.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As indicated on Shop Drawings.

C. Construct corners using minimum of three studs. Install minimum double studs at wall openings, door and window jambs unless calculations indicate more are required.

D. Install studs full length in one piece. Splicing of studs is not permitted.

E. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Connect vertical deflection clips to bypassing studs and anchor to building structure.

F. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

G. Touch-up field welds and damaged galvanized surfaces with primer.

H. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

I. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
   3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.05 FRAMING ACCESSORY INSTALLATION

A. Install accessories as required by structural design calculations. Provide appropriate fasteners in all predrilled holes backed by another framing member.

1. Bridging Clip for Cold Rolled Channel Bridging: Secure to stud web by inserting tabs through web slots. Secure to channel with one screw.

3.06 WALL SHEATHING

A. Wall Sheathing: Secure with long dimension parallel to wall studs, with ends over firm bearing and staggered, using self-tapping screws.
   1. Exterior Glass Mat Faced Sheathing Taping: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

3.07 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.08 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.09 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Steel framing and supports for sliding/folding aluminum glass wall system.
   2. Steel framing and supports for mechanical and electrical equipment.
   3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   4. Shelf angles.
   5. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
   2. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
   3. Section 05 12 00 "Structural Steel Framing."

1.02 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
   1. Steel framing and supports for mechanical and electrical equipment.
   2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   3. Shelf angles.
   4. Loose steel lintels.

B. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.06 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 316L.

D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.

E. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

F. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

G Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

H. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

2.03 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, unless noted otherwise, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

f. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.04 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
   2. Provide weldable primer for structural steel members shown to require field welding of connections.

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.05 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.05 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize all exposed exterior miscellaneous framing and supports and where indicated.

2.06 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.
   1. Provide mitered and welded units at corners.
   2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry.

C. Galvanize and prime shelf angles located in exterior walls.

2.07 METAL LADDERS

A. General:
   1. Comply with ANSI A14.3, except for elevator pit ladders.
   2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:
   1. Space siderails 16 inches apart unless otherwise indicated.
   2. Siderails: Continuous, 3/8-by-2-1/2-inch steel flat bars, with eased edges.
   3. Rungs: 3/4-inch-diameter steel bars.
   4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
   5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
   6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
   7. Galvanize and prime exterior ladders, including brackets.
   8. Provide security door with padlock hasp at foot of ladder to prevent unauthorized ladder use.

2.08 LADDER SAFETY CAGES

A. General:
   1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
   2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.

3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners unless otherwise indicated.

B. Steel Ladder Safety Cages:
1. Primary Hoops: 1/4-by-4-inch flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
3. Vertical Bars: 3/16-by-1-1/2-inch flat bars secured to each hoop.
4. Galvanize and prime ladder safety cages, including brackets and fasteners.

2.08 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime exterior miscellaneous steel trim.

2.09 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.

C. Hot dip galvanize loose steel lintels located in exterior walls, then paint lintels once installed. Coordinate primer and finish coats to be compatible with hot-dip galvanization. Provide full range color palette for Architect to select final color.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.12 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. Shop prime with universal shop primer.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 3, "Power Tool Cleaning." requirements indicated below:
   1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
   3. Other Items: SSPC-SP 3, "Power Tool Cleaning."

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.03 INSTALLING BEARING AND LEVELING PLATES

A. Clean masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

SECTION 05 51 13

METAL PAN STAIRS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preassembled steel stairs with concrete-filled treads.
   2. Steel tube railings attached to metal stairs.
   3. Steel tube handrails attached to walls adjacent to metal stairs.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.

1.02 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

1.03 ACTION SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

B. Delegated-Design Submittal: For stairs and railings, including analysis data signed and sealed by the qualified professional engineer licensed in North Carolina responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design stairs and railings.

B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
   2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
   3. Uniform and concentrated loads need not be assumed to act concurrently.

4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.

C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
   a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
   b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.
2. Infill of Guards:
   a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
   b. Infill load and other loads need not be assumed to act concurrently.

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500 (cold formed).

D. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

2.03 FASTENERS

A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

2.04 MISCELLANEOUS MATERIALS

A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

B. Concrete Materials and Properties: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa) unless otherwise indicated.

2.05 FABRICATION, GENERAL

A. Provide complete stair assemblies, including metal framing, hangers, struts,[railings,] clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
1. Join components by welding unless otherwise indicated.
2. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld connections to comply with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Weld exposed corners and seams continuously unless otherwise indicated.
   5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 4 welds: good quality, uniform undressed weld with minimal splatter.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated. Locate joints where least conspicuous.

2.06 STEEL-FRAMED STAIRS

A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:
   1. Fabricate stringers of steel channels.
   2. Construct platforms of steel plate headers and miscellaneous framing members as needed to comply with performance requirements.
   3. Weld or bolt stringers to headers; weld or bolt framing members to stringers and headers. If using bolts, fabricate and join so bolts are not exposed on finished surfaces.
   4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
   5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).
   1. Steel Sheet: Uncoated cold-rolled steel sheet unless otherwise indicated.
   2. Directly weld metal pans to stringers; locate welds on top of subtreads where they are concealed by concrete fill. Do not weld risers to stringers.
   3. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
   4. Shape metal pans to include nosing integral with riser.
   5. Provide subplatforms of configuration indicated or, if not indicated, the same as subtreads. Weld subplatforms to platform framing.
      a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.07 STAIR RAILINGS

A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
   1. Rails and Posts: As detailed on the Drawings.
   2. Picket Infill: 1/2 inch square steel bar pickets spaced less than 4 inches (100 mm) clear.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds: no evidence of a welded joint as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:
   1. As detailed.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

G. Connect posts to stair framing by direct welding unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
   1. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
   2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.08 FINISHES

A. Finish metal stairs after assembly.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.01 INSTALLING METAL PAN STAIRS

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.

C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.

D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

E. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.

G. Place and finish concrete fill for treads and platforms to comply with Section 03 30 00 "Cast-in-Place Concrete."

3.02 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
   1. Anchor posts to steel by welding to steel supporting members.
   2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as required to comply with performance requirements as follows:
   1. For hollow masonry anchorage, use toggle bolts.
   2. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.03 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

END OF SECTION

SECTION 05 52 13

PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Steel pipe railings.

1.02 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Railing brackets.
   2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.
   1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
   2. Fittings and brackets.
   3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
      a. Show method of connecting and finishing members at intersections.

D. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and licensed in North Carolina.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of stainless-steel products certifying that products furnished comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

F. Evaluation Reports: For post-installed anchors , from ICC-ES.

1.05 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Design railing assemblies, wall rails and attachments in strict accordance with the North Carolina State Building Code, 2016, Section 1607.7. Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
      b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C, material surfaces).

2.02 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
   1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.03 STEEL AND IRON

A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

B. Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.04 FASTENERS

A. General: Provide the following:
   1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.
   2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
   2. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

2.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

D. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

2.06 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
   1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.

J. Form Changes in Direction as Follows:
   1. As detailed.

K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of railing members with prefabricated end fittings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

2.07 STEEL AND IRON FINISHES

A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

B. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
   1. Shop prime uncoated railings with universal shop primer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
   1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
   2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
   3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.03 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.04 ANCHORING POSTS

A. Use metal 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 or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Cover anchorage joint with flange of same metal as post, attached to post with set screws.

3.05 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

3.06 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections located in the Bid Package Manual, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Rooftop equipment bases and support curbs.
   2. Wood blocking and nailers.
   3. Wood grounds.
   4. Plywood backing panels.

1.03 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater but less than 5 inches nominal (114 mm actual) in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. SPIB: The Southern Pine Inspection Bureau.

1.04 SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
   3. Provide dressed lumber, S4S, unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA C2.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat all miscellaneous carpentry, unless otherwise indicated.
   1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, and waterproofing.
   2. Wood blocking, and similar concealed members in contact with masonry or concrete.
   3. Wood framing and furring attached directly to masonry or concrete walls.

2.03 FIRE-RETARDANT-TREATED MATERIALS

A. General: Comply with performance requirements in AWPA C20 (lumber).
   1. Use treatment that does not promote corrosion of metal fasteners.
   2. Use Interior Type A, unless otherwise indicated.

B. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

C. Application: Treat items indicated on Drawings, and the following:
   1. Concealed blocking.
   2. Plywood backing panels.

2.04 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.
   3. Rooftop equipment bases and support curbs.
   4. Grounds.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber with 15 percent maximum moisture content and the following species:
   1. Mixed southern pine; SPIB.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
   1. Mixed southern pine, No. 2 grade; SPIB.

D. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.05 PLYWOOD BACKING PANELS

A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4 inch (19 mm) nominal thickness unless otherwise indicated.

2.06 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

B. Provide blocking as indicated and as required to support facing materials, fixtures, specialty items, and trim.

C. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

D. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

E. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 for power-driven fasteners.
   2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3.02 WOOD GROUNDS, BLOCKING AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

END OF SECTION

SECTION 06 20 23

INTERIOR FINISH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior trim.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Lumber: DOC PS 20.
   1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
      a. For exposed lumber, mark grade stamp on end or back of each piece, or omit grade stamp and provide certificates of grade compliance issued by inspection agency.

2.02 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
   1. Kiln dry lumber after treatment to a maximum moisture content of 19 percent.

B. Fire-retardant-treated wood shall not exceed the flame spread and smoke developed limitations of NCBC Table 803.9.

C. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
   1. For exposed lumber indicated to receive a stained or natural finish, mark back of each piece.

D. Application: All interior lumber.

2.03 INTERIOR TRIM

A. Hardwood Moldings for Transparent Finish (Stain or Clear Finish): WMMPA HWM 2, N-grade wood moldings made to patterns included in WMMPA HWM 1.
   1. Species: White maple.
   2. Maximum Moisture Content: 9 percent.

B. Molding Patterns: As detailed.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours unless longer conditioning is recommended by manufacturer.

3.02 INSTALLATION, GENERAL

A. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
   1. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   2. Countersink fasteners, fill surface flush, and sand unless otherwise indicated.
   3. Install to tolerance of 1/8 inch in 96 inches (3 mm in 2438 mm) for level and plumb. Install adjoining interior finish carpentry with 1/32-inch (0.8-mm) maximum offset for flush installation and 1/16-inch (1.5-mm) maximum offset for reveal installation.

3.03 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Miter at returns, miter at outside corners, and cope at inside corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints.

END OF SECTION

SECTION 06 41 16

PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Plastic-laminate-faced architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.

B. Related Requirements:
   1. Section 12 36 00 "Countertops."

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate and cabinet hardware and accessories.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

C. Samples:
   1. Plastic laminates, for each color, pattern, and surface finish.
   2. Thermoset decorative panels, for each color, pattern, and surface finish.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Fabricator of products.

1.04 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
   1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.

B. Grade: Custom.

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. Reveal Dimension: As indicated.

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. Formica Corporation.
      b. Lamin-Art, Inc.
      c. Panolam Industries International, Inc.
      d. Wilsonart International; Div. of Premark International, Inc.

G. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGL.
   2. Vertical Surfaces: Grade VGS.
   3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels unless otherwise indicated.

H. Materials for Semi-exposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: Thermoset decorative panels.
   2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
   3. Drawer Bottoms: Thermoset decorative panels.

I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As selected by Architect from laminate manufacturer's full range in the following categories:
      a. Solid colors with core same color as surface, scheduled finish.

2.02 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 8 to 13 percent.
   2. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
   3. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
   4. Softwood Plywood: DOC PS 1.
   5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.03 CABINET HARDWARE AND ACCESSORIES

A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.

B. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

C. Shelf Rests: BHMA A156.9, B04013; metal.

D. Drawer Slides: BHMA A156.9.
   1. Grade 1 and Grade 2: Side mounted; full-extension type; zinc-plated steel with polymer rollers.
   2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   3. For drawers not more than 3 inches (75 mm) high and not more than 24 inches (600 mm) wide, provide Grade 2.
   4. For drawers more than 3 inches (75 mm) high but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide Grade 1.
   5. For drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide Grade 1HD-100.
   6. For trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide, provide Grade 1HD-100.

E. Door Locks: BHMA A156.11, E07121.

F. Drawer Locks: BHMA A156.11, E07041.

G. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.

2.04 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

C. Adhesives: Do not use adhesives that contain urea formaldehyde.

D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement [Resorcinol].
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.05 FABRICATION

A. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

B. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.

3.02 INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm).

C. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

D. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.

E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch (38-mm) penetration into wood framing, blocking, or hanging strips.

END OF SECTION

SECTION 07 13 26

SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Modified bituminous sheet waterproofing.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
   3. Include manufacturer's certification that sheet waterproofing is compatible with monolithic membrane waterproofing specified in Section 07 14 13.

B. Samples: For each exposed product and for each color and texture specified, including the following products:
   1. 8-by-8-inch (200-by-200-mm) square of waterproofing and flashing sheet.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Sample Warranties: For special warranties.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
   1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.07 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard materials-only warranty in which manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.
   1. Warranty Period: Five years from date of Final Acceptance.

B. Installer's Special Warranty: Specified form, signed by Installer, covering Work of this Section, for warranty period of two years from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations for Waterproofing System: Obtain waterproofing materials, protection course, and molded-sheet drainage panels from single source from single manufacturer.

2.02 MODIFIED BITUMINOUS SHEET WATERPROOFING

A. Modified Bituminous Sheet: Minimum 60-mil (1.5-mm) nominal thickness, self-adhering sheet consisting of 56 mils (1.4 mm) of rubberized asphalt laminated on one side to a 4-mil- (0.10-mm-) thick, polyethylene-film reinforcement, and with release liner on adhesive side; formulated for application with primer or surface conditioner that complies with VOC limits of authorities having jurisdiction.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following]:
      a. American Hydrotech, Inc; VM75.
      b. Carlisle Coatings & Waterproofing Inc; CCW MiraDRI 860/861.
      c. Grace Construction Products; W.R. Grace & Co. -- Conn ; Bituthene 4000.
      d. Henry Company; Blueskin WP 100/200.
      e. Meadows, W.R.,Inc; SealTight Mel-Rol.
      f. Nervastral, Inc; BITU-MEM.
      g. Polyguard Products, Inc; Polyguard 650.
      h. Soprema; COLPHENE 3000.
      i. York Manufacturing, Inc; HydroGard.
   2. Physical Properties:
      a. Tensile Strength, Membrane: 250 psi (1.7 MPa) minimum; ASTM D 412, Die C, modified.
      b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
      c. Low-Temperature Flexibility: Pass at minus 20 deg F (minus 29 deg C); ASTM D 1970.
      d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch (3-mm) movement; ASTM C 836.
      e. Puncture Resistance: 40 lbf (180 N) minimum; ASTM E 154.
      f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F (21 deg C); ASTM D 570.
      g. Water Vapor Permeance: 0.05 perms (2.9 ng/Pa x s x sq. m) maximum; ASTM E 96/E 96M, Water Method.
      h. Hydrostatic-Head Resistance: 200 feet (60 m) minimum; ASTM D 5385.
   3. Sheet Strips: Self-adhering, rubberized-asphalt strips of same material and thickness as sheet waterproofing.

2.03 AUXILIARY MATERIALS

A. General: Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.
   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

B. Primer: Liquid primer recommended for substrate by sheet-waterproofing material manufacturer.

C. Surface Conditioner: Liquid, waterborne surface conditioner recommended for substrate by sheet-waterproofing material manufacturer.

D. Liquid Membrane: Elastomeric, two-component liquid, cold fluid applied, of trowel grade or low viscosity.

E. Substrate Patching Membrane: Low-viscosity, two-component, modified asphalt coating.

F. Metal Termination Bars: Aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick, predrilled at 9-inch (229-mm) centers.

2.04 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 (0.21-mm) sieve laminated to one side of the core and a polymeric film bonded to the other side; and with a vertical flow rate of 9 to 15 gpm per ft. (112 to 188 L/min. per m).
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. American Hydrotech, Inc; Hydrodrain 400.
      b. Carlisle Coatings & Waterproofing Inc; CCW MiraDRAIN 6000.
      c. Grace Construction Products; W.R. Grace & Co. -- Conn; Hydroduct 220.

2.05 INSULATION

A. Board Insulation: Extruded-polystyrene board insulation complying with ASTM C 578, shiplap edged.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dow Chemical Company (The); STYROFOAM Brand Tongue and Groove Insulation.
      b. Kingspan Insulation, LLC.
      c. Owens Corning Insulating Systems LLC.
   2. Type IV, 25-psi (173-kPa) minimum compressive strength.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the waterproofing.
   1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

F. Bridge and cover expansion joints with overlapping sheet strips of widths according to manufacturer's written instructions.
   1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
   1. Install membrane strips centered over vertical inside corners. Install 3/4-inch (19-mm) fillets of liquid membrane on horizontal inside corners and as follows:
      a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.03 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.

B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.

C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- (64-mm-) minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
   1. When ambient and substrate temperatures range between 25 and 40 deg F (minus 4 and plus 5 deg C), install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F (16 deg C).

D. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.

E. Seal edges of sheet-waterproofing terminations with mastic.

F. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches (150 mm) beyond repaired areas in all directions.

G. Immediately install protection course with butted joints over waterproofing membrane.

3.04 MOLDED-SHEET DRAINAGE-PANEL INSTALLATION

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, according to manufacturer's written instructions. Use adhesives or other methods that do not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction and provide continuous termination bars as recommended by manufacturer.

3.05 INSULATION INSTALLATION

A. Install board insulation to achieve required thickness over the drainage panels. Cut and fit to within 3/4 inch (19 mm) of projections and penetrations.

B. On vertical surfaces, set insulation units in adhesive or tape applied according to manufacturer's written instructions.

C. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.06 PROTECTION, REPAIR, AND CLEANING

A. Protect waterproofing from damage and wear during remainder of construction period.

B. Protect installed board insulation and insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 17 13

BENTONITE PANEL WATERPROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Bentonite clay waterproofing panels and accessories.

1.02 REFERENCE STANDARDS

A. NRCA (WM) - The NRCA Waterproofing Manual.

1.03 SUBMITTALS

A. Product Data: Provide product criteria, characteristics, accessories, jointing and seaming methods, and termination conditions.

B. Shop Drawings: Indicate required flashings and control joints, sealing at openings and projections.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Maintain bentonite products dry. Protect with waterproof cover.

B. Maintain minimum ambient storage temperatures of 40 degrees F (5 degrees C) for bentonite gel products.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Construction Manager shall correct defective Work within a five year period after Date of Final Acceptance; remove and replace materials concealing waterproofing at no extra cost to Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers:
   1. Epro Waterproofing Systems: www.eproserv.com/#sle.
   2. CETCO: www.cetco.com/#sle.
   3. Tremco Commercial Sealants and Waterproofing: www.tremcosealants.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Bentonite: Granulated pure, dry, bentonite clay comprised of 90 percent minimum sodium montmorillonite; 90 percent minimum passing No. 20 (850 micro m) mesh sieve and 10 percent maximum passing No. 200 (75 micro m) mesh sieve.

B. Three-Ply Panels: Triple corrugated core, smooth faced Kraft paper panels, center core filled with self expanding bentonite clay granules, outer layers placed at right angles to core layer.
   1. Nominal Panel Size: 48 by 48 by 5/8 inches (1200 by 1200 by 16 mm).
   2. Minimum Bentonite Fill: 1 lb/sq ft (5 kg/sq m).
   3. Minimum Panel Weight: 24 lbs (11 kg).

C. Joint Packing: Biodegradable Kraft paper containers filled with bentonite clay granules; 1-1/4 inches (32 mm) square or 2-3/8 inch (60 mm) triangular by 24 inches (600 mm) long.

D. Joint Seal: Moist and hydrated bentonite clay gel using water and glycol for below-freezing application and water for above-freezing application.

2.03 ACCESSORIES

A. Fasteners: Galvanized nails.

B. Adhesive: Manufacturer's recommended type.

C. Drainage Panel: 1/4 inch (6.4 mm) thick formed plastic, hollowed sandwich.

D. Protection Board: 1/2 inch (12.7 mm) thick biodegradable hardboard.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify substrate surfaces are smooth and durable; free of matter detrimental to application of waterproofing system.

C. Verify that items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

B. Remove concrete fins, projections, and form ties.

C. Fill holes, cracks, honeycombs, and voids with bentonite gel seal, at least 1/8 inch (3 mm) thick, extending 3 inches (76 mm), minimum, beyond defect.

3.03 INSTALLATION - GENERAL

A. Install panels in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Cut panels parallel to corrugations to prevent bentonite loss.

C. Seal construction joints with joint seal.

3.04 INSTALLATION - VERTICAL SURFACES

A. Install three-ply panels with masonry nails, starting at base of foundation.

B. Fold panels around corners with corrugations vertical, and install unfolded panels with corrugations horizontal.

C. Lap adjoining panels 1-1/2 inches (38 mm).

D. Stagger vertical joints minimum 16 inches (406 mm) on succeeding courses.

E. Install one extra layer of panels at external corners.

3.05 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

A. Install drainage panel directly over waterproofing, butt joints, and position to ensure downward drainage.

B. Install protection board over drainage panel; butt joints.

C. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

SECTION 07 21 00

THERMAL INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Glass-fiber blanket insulation.
   2. Mineral-wool blanket insulation.
   3. Spray polyurethane foam insulation.

B. Related Sections:
   1. Section 04 20 00 "Unit Masonry" for insulation installed in cavity walls.
   2. Section 07 84 46 "Fire-Resistive Joint Systems" for insulation installed as part of a perimeter fire-resistive joint system.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.03 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.04 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.01 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. CertainTeed Corporation .
   2. Johns Manville.
   3. Knauf Insulation.
   4. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics. Provide minimum R-Value of 13 unless otherwise indicated or required by code.

2.02 MINERAL-WOOL BLANKET INSULATION (SOUND ATTENUATION)

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Fibrex Insulations Inc.
   2. Owens Corning.
   3. Roxul Inc.
   4. Thermafiber.

B. Unfaced, Mineral-Wool Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing) and ASTM C423 for coefficient frequencies for thickness indicated; consisting of fibers; with maximum flame-spread and smoke-developed indexes of 0 0 per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.03 SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Polyurethane Foam Insulation: ASTM C 1029, Type II, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Corporation.
      b. Gaco Western Inc.
      c. Henry Company.
      d. Icynene Inc.
      e. NCFI; Division of Barnhardt Mfg. Co.
   2. Minimum density of 1.5 lb/cu. ft. (24 kg/cu. m), thermal resistivity of 6.2 deg F x h x sq. ft./Btu x in. at 75 deg F (43 K x m/W at 24 deg C).

2.04 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch (0.762 mm) thick by 2 inches (50 mm) square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position indicated with self-locking washer in place.
   1. Angle: Formed from 0.030-inch- (0.762-mm-) thick, perforated, galvanized carbon-steel sheet with each leg 2 inches (50 mm) square.
   2. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch (2.67 mm) in diameter; length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean substrates of substances that are harmful to insulation[or vapor retarders, including removing projections capable of puncturing vapor retarders,] or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical surfaces, set insulation units loosely laid according to manufacturer's written instructions.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
   1. If not otherwise indicated, extend insulation a minimum of 24 inches (610 mm) in from exterior walls.

3.04 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Spray-Applied Insulation: Apply spray-applied insulation according to manufacturer's written instructions. .

C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.05 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where mineral wool blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches (1219 mm) up either side of partitions.

3.06 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Flat Polyiso Roof Insulation
   1. Faced with oriented strand board or waferboard on one major surface of the core foam and GRF or CGF facer on the other major surface of the core foam.
   2. Accessories
      a. Atlas Nailable Insulation Fasteners

1.02 RELATED SECTIONS

A. Section 07 61 00 - Sheet Metal Roofing.

1.03 REFERENCES

A. ASTM C1289: Standard Specification for Faced Rigid Cellular Polyisocyanurate Insulation Board.

B. ASTM D312: Standard Specification for Asphalt Used in Roofing.

C. ASTM E108: Standard Test Methods for Fire Tests or Roof Coverings.

D. ASTM E119: Standard Test Methods for Fire Tests of Building Construction and Materials.

E. FM 4450: Approval Standard - Class I Insulated Steel Roof Decks

F. FM 4470: Approval Standard - Class I Roof Covers.

G. LTTR: Long Term Thermal Resistance predicated by CAN/ULC-S770-09.

H. UL 263: Fire Tests of Building Construction and Materials.

I. UL 790: Standard Test Methods for Fire Tests of Roof Coverings.

J. UL 1256: Fire Test Methods for Fire Tests of Roof Coverings.

K. ASTM E2114: Standard Terminology for Sustainability Relative to the Performance of Buildings.

L. ASTM E2129: Standard Practice for Data Collection for Sustainability Assessment of Building Products.

1.04 DEFINITIONS

A. LTTR (Long Term Thermal Resistance): Defined as using techniques from ASTM C1303 or CAN/ULC-S770-09, the predicated R-Value that has been shown to be equivalent to the average performance of a permeably faced foam insulation product over 15 years. LTTR applies to ALL foam insulation products with blowing agents other than air, such as Polyiso, extruded polystyrene and polyurethane. The new method is based on consensus standards in the US and Canada.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data:
   1. Installation instructions for insulation board and fasteners.
   2. Product Data as per ASTM E2129: Standard Practice for Data Collection for Sustainability Assessment of Building Products.

C. Samples:
   1. Submit minimum 6 inch by 6 inch (152 millimeters by 152 millimeters) of each board type required.
   2. Submit samples of each fastener type required.

D. Shop Drawings:
   1. Roof plan showing layout of boards and fastening patterns.

E. Certificates:
   1. System Manufacturer's or Insulation Manufacturer's Certification that the insulation meets Zero ODP (Ozone Depletion Potential) and Zero GWP (Global Warming Potential) specification requirements.

F. Thermal Warranty:
   1. Submit sample warranty indicating conditions and limitations.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this section with minimum twenty five years documented experience.

B. Installer Qualifications: Company specializing in the installation of products specified in this section with minimum 5 years documented experience in installing products of the same type and scope as specified.

C. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions and insulation manufacturer's installation instructions.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver product in packages labeled with material name, thermal value and product code.

B. When stored outdoors or on the jobsite, the insulation should be stacked on pallets at least three inches above ground level and completely covered with a waterproof covering such as a tarpaulin. The temporary factory-applied packaging should be slit or removed to prevent accumulation of condensation. Insulation which has become wet or damaged should be removed and replaced with solid, dry insulation.

1.08 SEQUENCING

A. Ensure that information required for installation of products in this section is furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

C. Coordinate installation with roof membrane manufacturer's installation instructions.

1.09 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Atlas Roofing Corporation
   1. Address: 2000 Riveredge Parkway Suite 800 Atlanta, GA 30328
   2. Phone: 800-388-6134
   3. Fax: 770-952-3170
   4. Web: www.atlasroofing.com

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. ACFoam CrossVent Nailable Cross Ventilated Roof Insulation: Thermally efficient cross ventilated non-structural composite insulation. Consisting of closed-cell ACFoam-III polyisocyanurate (polyiso) roof insulation board and Oriented Strand Board (OSB) or CDX Plywood separated with and bonded to 5 individual Expanded Polystyrene vent spacer strips.
   1. Compliance:
      a. ASTM C1289, Type V.

b. UL Standard 1256 Classification: Construction No. 120, 123 & 458.
c. UL Standard 790 (ASTM E108): For use with Class A, B or C Shingles, Metal or Tile Roof Coverings.
d. UL Standard 263 (ASTM E119): Fire Resistance Classification.
e. FM Standard 4450 & 4470 Approved (1-90, 1-105): Approved for Class 1 Insulated Roof Deck Construction. Refer to FM Approvals® RoofNav for Specific Systems Details.
f. IBC Chapter 26 & National Building Code: Sections on Foam Insulation.
g. California State Insulation Quality Standards.
h. Title 25 Foam Flammability Criteria (T 1231).
i. Miami-Dade County Product Control Approved.
j. State of Florida Product Approval: FL17989.
k. APA/TECO Rated OSB Nailing Surface.
l. Federal Housing Administration (FHA) Minimum Property & Asphalt Roofing Manufacturers Association (ARMA) Insulated Deck Requirements.
m. Dimensional Stability (ASTM D2126): less than 2 percent.
n. Compressive Strength (ASTM D1621): 20 pounds per square inch (140 kPa) or 25 pounds per square inch (172 kPa).
o. Water Absorption (ASTM C209): less than 1.0 percent.
p. Water Absorption (ASTM D2842): less than 3.5 percent.
q. Water Vapor Transmission (ASTM E96): less than 1.0 perm (57.5ng/(Pa•s•m2))
r. Product Density (ASTM D1622): Nominal 2.0 pounds per cubic foot (32.04 kg/m3).
s. Flame Spread (ASTM E84 10 minimum): 40-60.
t. Smoke Development (ASTM E84 10 minimum): 50-170.
u. Tensile Strength (ASTM D1623): greater than 730 pounds per square foot (35 kPa).
v. Service Temperature: -100°F to +250°F.
w. Panel Area:
    1) 4 feet x 8 feet (1220 millimeters x 2440 millimeters)
x. 1.0 inch Air Space Composite Panel Thickness: Composite calculations include polyiso layer, 1.0 inch EPS vent spacer strip and 7/16 inch OSB.
    1) 3.0 inch (76.2 millimeters): LTTR - 8.6
y. Vent Strip Compatibility:
    1) 1.0 inch (25.4 millimeters) x 4.0 inch (101.6 millimeters)
        (a) NFA = 9.5 square inch per linear foot.
        (b) Compressive: 6000 pounds per square foot compressive resistance
        (c) Moisture, Mold and Rot Resistant
        (d) Continuous fastening support for projects which require an excess of 30 fasteners.
z. Wood Layer Compatibility:
    1) OSB
        (a) 7/16 inch (11 millimeters): R - 0.55
    2) CDX
        (a) 5/8 inch (16 millimeters): R - 0.78

2.03 ACCESSORIES

A. Atlas Nail Base Fastener: Engineered fastener for ACFoam CrossVent Nailable insulation to an approved substrate. Required for proper attachment of all ACFoam Nailable insulation products.
    1. Material: Case hardened and Tempered Carbon Steel
    2. Head Style/Drive: Pancake Head with T-30 Internal Drive
    3. Head Diameter: 0.635 inch
    4. Shank Diameter: 0.190 inch
    5. Thread Length: 2.750 inch

6. Point: #2 (0.135 inch diameter) Drill Point
7. Coating: Epoxy E-Coat (Black)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roof deck for suitability to receive insulation.

B. Verify that substrate is dry, clean and free of foreign material that will damage insulation or impede installation.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Verify that roof drains, scuppers, roof curbs, nailers, equipment supports, vents and other roof accessories are secured properly and installed in conformance with Contract Documents.

E. Verify that deck is structurally sound to support installers, materials and equipment without damaging or deforming work.
   1. Start of installation indicates installer accepts conditions of existing deck surfaces.

3.02 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.

C. Verify the manufacturer’s roof edge details for accuracy to fit the assembly

3.03 INSTALLATION

A. Install in accordance with manufacturer’s installation instructions.

B. Install specified insulation using approved mechanical fasteners, hot asphalt or adhesives in accordance with manufacturer’s latest written instructions and as required by governing codes and Owner’s insurance carrier.

C. Install with end joints staggered to avoid having insulation joints coinciding with joints in deck. In multi-layer installations, stagger joints in top and bottom layers.

3.04 PROTECTION

A. Remove trash and construction debris from insulation surface prior to application of roofing membrane.

B. Do not leave installed insulation exposed to weather. Cover and waterproof completed roof system immediately after installation.
   1. Temporarily seal exposed insulation edges at the end of each day.
   2. Remove and replace installed insulation that has become wet or damaged with new insulation.

C. Protect installed insulation and roof cover from traffic by use of protective covering materials during and after installation.

END OF SECTION

SECTION 07 42 13

METAL WALL PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for walls and soffits, with related flashings and accessory components.

1.02 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.

1.03 SUBMITTALS

A. Shop Drawings: Indicate dimensions, layout, joints, construction details, and methods of anchorage.

B. Samples: Submit two samples of wall panel and soffit panel, 12 inch by 12 inch (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

C. Prevent contact with materials that may cause discoloration or staining of products.

1.05 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

B. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Metal Wall Panels - Concealed Fasteners and Metal Soffit Panels.
   1. FW-12 Panels manufactured by Berridge.

B. Other Acceptable Manufacturers - Metal Wall Panels - Concealed Fasteners:
   1. ATAS International, Inc: www.atas.com/#sle.
   2. Centria: www.centria.com/#sle.
   3. Petersen Aluminum Corporation: www.pac-clad.com/#sle.

2.02 MANUFACTURED METAL PANELS

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
   1. Provide exterior panels and soffit panels.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Design Pressure: In accordance with applicable codes.
   4. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
   5. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   6. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

7. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
8. Corners: Factory-fabricated in one continuous piece with minimum 2 inch (51 mm) returns.

B. Exterior Panels:
1. Profile: Vertical; style as indicated.
2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
3. Material: Precoated steel sheet, 22 gage, 0.0299 inch (0.76 mm) minimum thickness.
4. Panel Width: 12 inches (305 mm).
5. Color: As selected by Architect from manufacturer's full line.

C. Soffit Panels:
1. Profile: Style as indicated.

D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

E. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

F. Anchors: Galvanized steel.

2.03 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

2.04 FINISHES

A. Custom Fluoropolymer Coating System: Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness (DFT) of 0.9 mil (0.023 mm); color and gloss as indicated on drawings.

2.05 ACCESSORIES

A. Concealed Sealants: Non-curing butyl sealant or tape sealant.

B. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.02 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

C. Fasten panels to structural supports; aligned, level, and plumb.

D. Locate joints over supports.

E. Use concealed fasteners unless otherwise approved by Architect.

3.03 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch (1.6 mm).

B. Maximum Variation from Plane or Location Indicated on Drawings: 1/4 inch (6.4 mm).

3.04 CLEANING

A. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 54 19

POLYVINYL-CHLORIDE (PVC) ROOFING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Adhered polyvinyl-chloride (PVC) roofing system.
   2. Roof insulation.

B. Related Requirements:
   1. Section 06 10 53 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
   2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
   3. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.02 PREINSTALLATION MEETINGS

A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.

8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work, including:
   1. Base flashings and membrane terminations.
   2. Tapered insulation, including slopes.
   3. Roof plan showing orientation of steel roof deck and orientation of roofing, fastening spacings, and patterns for mechanically fastened roofing.
   4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:
   1. Sheet roofing, of color required.
   2. Walkway pads or rolls, of color required.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is FM Global approved for roofing system identical to that used for this Project.

B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
   1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.07 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
   1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
   2. Warranty Period: 20 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain components including roof insulation fasteners for roofing system from same manufacturer as membrane roofing or manufacturer approved by membrane roofing manufacturer.

B. Polyvinyl Chloride (PVC) Membrane Materials:
   1. Carlisle Roofing Systems, Inc.
   2. Duro-Last Roofing Inc.
   3. GAF;.
   4. Sarnafil Inc.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and base flashings shall remain watertight.
   1. Accelerated Weathering: Roofing system shall withstand 2000 hours of exposure when tested according to ASTM G 152, ASTM G 154, or ASTM G 155.
   2. Impact Resistance: Roofing system shall resist impact damage when tested according to ASTM D 3746 or ASTM D 4272.

B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

C. Roofing System Design: Tested by a qualified testing agency to resist the following uplift pressures:
   1. Corner Uplift Pressure: See Structural Drawings.
   2. Perimeter Uplift Pressure: See Structural Drawings.
   3. Field-of-Roof Uplift Pressure: See Structural Drawings.
   4. Fire/Windstorm Classification: Class 1A-90.

D. Exterior Fire-Test Exposure: ASTM E 108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.03 PVC ROOFING

A. PVC Sheet: ASTM D 4434/D 4434M, Type III, fabric reinforced.
   1. Thickness: 60 mils (1.5 mm), nominal.
   2. Exposed Face Color: White.

2.04 AUXILIARY ROOFING MATERIALS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with roofing.
   1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.

C. Bonding Adhesive: Manufacturer's standard.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.

F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch (25 mm wide by 1.3 mm) thick, prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roofing to substrate, and acceptable to roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.05 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, 1/2 inch (13 mm) thick.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening substrate board to roof deck.

2.06 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by PVC roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Atlas Roofing Corporation.
      b. Carlisle SynTec Incorporated.
      c. Firestone Building Products.
      d. Hunter Panels.
      e. Johns Manville; a Berkshire Hathaway company.
      f. Rmax, Inc.

2.07 INSULATION ACCESSORIES

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Global 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
   1. Modified asphaltic, asbestos-free, cold-applied adhesive.
   2. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
   3. Full-spread spray-applied, low-rise, two-component urethane adhesive.

D. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

2.08 ASPHALT MATERIALS

A. Roofing Asphalt: ASTM D 312, Type III or Type IV.

2.09 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch (5 mm) thick and acceptable to roofing system manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work:
   1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
   2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
   3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 ROOFING INSTALLATION, GENERAL

A. Install roofing system according to roofing system manufacturer's written instructions.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.04 SUBSTRATE BOARD INSTALLATION

A. Install substrate board with long joints in continuous straight lines, perpendicular to roof slopes with end joints staggered between rows. Tightly butt substrate boards together.
   1. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.05 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches (68 mm) or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches (150 mm) in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
   1. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.

G. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.
   1. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

3.06 ADHERED ROOFING INSTALLATION

A. Adhere roofing over area to receive roofing according to roofing system manufacturer's written instructions. Unroll roofing and allow to relax before retaining.
   1. Install sheet according to ASTM D 5036.

B. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

C. Accurately align roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of roofing at rate required by manufacturer, and allow to partially dry before installing roofing. Do not apply to splice area of roofing.

E. In addition to adhering, mechanically fasten roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap roofing, and hot-air weld side and end laps of roofing and sheet flashings according to manufacturer's written instructions, to ensure a watertight seam installation.
   1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet.
   2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
   3. Repair tears, voids, and lapped seams in roofing that do not comply with requirements.

H. Spread sealant bed over deck-drain flange at roof drains, and securely seal roofing in place with clamping ring.

3.07 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.08 WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.09 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

3.10 ROOFING INSTALLER'S WARRANTY

A. WHEREAS _____ of _____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
   1. Owner: <Insert name of Owner>.
   2. Address: <Insert address>.
   3. Building Name/Type: <Insert information>.
   4. Address: <Insert address>.
   5. Area of Work: <Insert information>.
   6. Acceptance Date: _____.
   7. Warranty Period: <Insert time>.
   8. Expiration Date: _____.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
   1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
      a. lightning;
      b. peak gust wind speed exceeding <Insert mph (m/sec)>;
      c. fire;
      d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
      e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
      f. vapor condensation on bottom of roofing; and
      g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
   2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
   3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
   4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said

alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____ day of _____, _____.

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION

SECTION 07 61 00

SHEET METAL ROOFING

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 SUMMARY

A. This Section includes the following on-site, roll-formed sheet metal roofing:
   1. Standing-seam metal roofing.

B. Related Sections include the following:
   1. Division 07 Section "Roof and Deck Insulation" for sheet metal roofing substrate.
   2. Division 07 Section "Sheet Metal Flashing and Trim" for flashings and other sheet metal work not part of sheet metal roofing.
   3. Division 07 Section "Joint Sealants" for field-applied sheet metal roofing sealants.

1.03 PERFORMANCE REQUIREMENTS

A. General: Provide complete sheet metal roofing system, including, but not limited to, custom-fabricated metal roof pans, cleats, clips, anchors and fasteners, sheet metal flashing and drainage components related to sheet metal roofing, fascia panels, trim, underlayment, and accessories as indicated and as required for a weathertight installation.

B. Wind-Uplift Resistance: Provide portable roll-forming equipment capable of producing sheet metal roofing assemblies that comply with UL 580 for Class 90 wind-uplift resistance.

C. Thermal Movements: Provide sheet metal roofing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal roofing thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide sheet metal roofing that does not allow water infiltration to building interior, with metal flashing and connections of sheet metal roofing lapped to allow moisture to run over and off the material.

1.04 SUBMITTALS

A. Product Data: For each product indicated. Include details of construction relative to materials, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, and keyed references to termination points. Distinguish between shop- and field-assembled work. Include the following:
   1. Details for forming sheet metal roofing, including seams and dimensions.
   2. Details for joining and securing sheet metal roofing, including layout of fasteners, clips, and other attachments. Include pattern of seams.
   3. Details of termination points and assemblies, including fixed points.
   4. Details of edge conditions.
   5. Details of special conditions.
   6. Details of connections to adjoining work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Sheet Metal Roofing: 12 inches (300 mm) long by actual pan width, including finished seam. Include fasteners, cleats, clips, closures, and other attachments.
   2. Trim and Closures: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
   3. Accessories: 12 inch (300 mm) long Samples for each type of accessory.

D. Qualification Data: For Installer.

E. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: An authorized representative of roll-formed sheet metal roofing manufacturer for fabrication and installation of units required for this Project.

B. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

C. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to sheet metal roofing including, but not limited to, the following:
   1. Meet with Owner, Architect, Owner's insurer if applicable, sheet metal roofing Installer, manufacturer's representative for sheet metal roofing portable roll-forming equipment, metal deck Installer, and installers whose work interfaces with or affects sheet metal roofing including installers of roof accessories and roof-mounted equipment.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to sheet metal roofing installation, including portable roll-forming equipment manufacturer's written instructions.
   4. Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
   5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal roofing.
   6. Review governing regulations and requirements for insurance, certificates, and testing and inspecting if applicable.
   7. Review temporary protection requirements for sheet metal roofing during and after installation.
   8. Review roof observation and repair procedures after sheet metal roofing installation.
   9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal coils, sheet metal roofing pans, components, and other sheet metal roofing materials so as not to be damaged or deformed. Package sheet metal roofing materials for protection during transportation and handling.

B. Unload, store, and erect sheet metal roofing materials in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal coils and sheet metal roofing materials to ensure dryness. Do not store metal coils or sheet metal roofing materials in contact with other materials that might cause staining, denting, or other surface damage.

1.07 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Water Tightness Warranty: 10 years from date of Final Acceptance.
   2. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   3. Finish Warranty Period: 20 years from date of Final Acceptance.

B. Special Installer's Warranty: Roofing Installer's warranty, on warranty form at end of this Section, signed by Roofing Installer, in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Loose parts.
      b. Wrinkling or buckling.
      c. Failure to remain weathertight, including uncontrolled water leakage.
      d. Deterioration of metals, metal finishes, and other materials beyond normal weathering, including nonuniformity of color or finish.
      e. Galvanic action between sheet metal roofing and dissimilar materials.
   2. Warranty Period: Two years from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Berridge; Product Double-Lock Zee-Lock (Basis of Design).

B. Other Acceptable Manufacturers:
   1. AEP-Span.
   2. Centeria.
   3. MBCI.
   4. Metal Roofing Systems, Inc.
   5. McElroy Metal, Inc.
   6. Merchant & Evans.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS AND FINISHES

A. Prefinished metal shall be Aluminum-Zinc Alloy Coated (AZ-50 Galvalume) Steel Sheet, 24-Gauge ASTM 792-08, Grade 40, yield strength 40 ksi min.

B. Color shall custom color as selected by the Architect.

C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.

D. If Strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.

E. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.

F. Closures: use composition or metal profiled closures at the top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.

G. Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates.

H. Roofing Underlayment
   1. On all surfaces to be covered with roofing material, furnish and install a 40 mil "Peel & Stick membrane", required as outlined by metal panel manufacturer. Membrane to be a minimum of 40 mil thickness, smooth, non-granular, by one of the following manufacturers:
      a. W.R Grace "Ice & water Shield HT"
      b. Carlisle CCW WIP 300HT
      c. MFM Corp "Wind & Water Shield"
      d. Polyguard Deck Guard HT of Polyglas HT
   2. Underlayment shall be laid in horizontal layers with joints lapped toward the eaves a minimum of 6 inches, and well secured along laps and at ends as necessary to properly hold the felt in place. All underlayment shall be preserved unbroken and whole.
   3. Underlayment shall lap all hips and ridges at least 12 inches to form double thickness and shall be lapped 6 inches over the metal of any valley or built-in gutters and shall be installed as required by the Standing Seam Panel Manufacturer to attain the desired 20 Year Weathertightness Warranty.

I. Sealants
   1. Provide two-part polysulfide class B non-sag type for vertical and horizontal joints or
   2. one part polysulfide not containing pitch or phenolic extenders or
   3. Exterior grade silicone sealant recommended by roofing manufacturer or one part non-sag, gun grade exterior type polyurethane recommended by the roofing manufacturer.

2.03 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

B. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   1. Exposed Fasteners: Heads matching color of sheet metal roofing by means of plastic caps or factory-applied coating.
   2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws with hex washer head.
   3. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

D. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight and as recommended by roll-formed sheet metal roofing manufacturer for installation indicated.

2.04 ACCESSORIES

A. Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated.
   1. Closures: Provide closures at eaves and ridges, fabricated of same metal as sheet metal roofing.
   2. Clips: Minimum 0.0625 inch (1.6 mm) thick, stainless-steel panel clips designed to withstand negative-load requirements.
   3. Cleats: Mechanically seamed cleats formed from the following material:
      a. Metallic-Coated Steel Roofing: 0.0250 inch (0.65 mm) thick, stainless-steel or nylon-coated aluminum sheet.

4. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
5. Closures: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1 inch (25 mm) thick, flexible closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Formed from 0,032 inch (0.81 mm) thick, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent sheet metal roofing.

C. Gutters: Formed from 0.040 inch (1.00 mm) thick, aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96 inch (2400 mm) long sections, sized according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced 36 inches (900 mm) o.c., fabricated from same metal as gutters. Provide bronze, copper, or aluminum wire ball strainers at outlets. Finish gutters to match sheet metal roofing.

D. Downspouts: Formed from 0.032 inch (0.81 mm) thick, zinc alloy-coated steel sheet prepainted with coil coating; in 10 foot (3 m) long sections, complete with formed elbows and offsets. Finish downspouts to match sheet metal roofing.

2.05 EQUIPMENT

A. Portable Roll-Forming Equipment: Manufacturer's standard UL-certified equipment capable of forming sheet metal roofing in profiles indicated.
1. Available Manufacturers:
a. AEP-Span.
b. Berridge Manufacturing Company.
c. MBCI.
d. McElroy Metal, Inc.

2.06 FABRICATION

A. General: Custom fabricate sheet metal roofing to comply with details shown and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest extent possible.
1. Standing-Seam Roofing: Form standing-seam pans with finished seam height of 1-1/2 inch (of 38 mm).

B. General: Fabricate roll-formed sheet metal roofing panels to comply with details shown and roll-formed sheet metal roofing manufacturer's written instructions.

C. Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.
1. Fold and cleat eaves and transverse seams in the shop.
2. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required for leakproof construction.

D. Sealant Joints: Where movable, non-expansion-type joints are indicated or required to produce weathertight seams, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

E. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.

F. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before shop fabrication.
   1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
   2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
   3. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
   4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
   5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
      a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, sheet metal roofing supports, and other conditions affecting performance of work.
   1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances.
   2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored, and that provision has been made for flashings, and penetrations through sheet metal roofing.

B. Examine roughing-in for components and systems penetrating sheet metal roofing to verify actual locations of penetrations relative to seam locations of sheet metal roofing before sheet metal roofing installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Install flashings and other sheet metal to comply with requirements specified in Division 07 Section "Sheet Metal Flashing and Trim."

3.03 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on roof sheathing under sheet metal roofing. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply over entire roof, in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.
   1. Roof perimeter for a distance up from eaves of 24 inches (600 mm) beyond interior wall line.
   2. Rake edges for a distance of 18 inches (460 mm) .
   3. Roof to wall intersections for a distance from wall of 18 inches (460 mm) .

3.04 INSTALLATION, GENERAL

A. General: Install sheet metal roofing perpendicular to purlins or supports. Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.
   1. Field cutting of sheet metal roofing by torch is not permitted.
   2. Rigidly fasten eave end of sheet metal roofing and allow ridge end free movement due to thermal expansion and contraction. Predrill roofing.
   3. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.
   4. Locate and space fastenings in uniform vertical and horizontal alignment.
   5. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.

B. Fasteners: Use fasteners of sizes that will not penetrate completely through substrate.
   1. Steel Roofing: Use stainless-steel fasteners.

C. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

3.05 ON-SITE, ROLL-FORMED SHEET METAL ROOFING INSTALLATION

A. General: Install on-site, roll-formed sheet metal roofing to comply with sheet metal roofing manufacturer's written instructions for UL wind-uplift class indicated. Provide sheet metal roofing of full length from eave to ridge unless otherwise restricted by shipping limitations.

B. Standing-Seam Sheet Metal Roofing: Fasten sheet metal roofing to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended by manufacturer.
   1. Install clips to supports with self-tapping fasteners.
   2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
   3. Before panels are joined, apply continuous bead of sealant to top flange of lower panel.
   4. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging field-applied sealant.
   5. Seamed Joint: Crimp standing seams with manufacturer-approved motorized seamer tool so cleat, sheet metal roofing, and field-applied sealant are completely engaged.

3.06 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 sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

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 (3 m) with no joints allowed within 24 inches (600 mm) 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 (25 mm) deep, filled with mastic sealant (concealed within joints).

C. Gutters: Join sections with soldered joints. Install gutters as detailed on the Drawings. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

D. Downspouts: Join sections with 1-1/2 inch (38 mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
1. Tie downspouts to underground drainage system indicated.
2. Install downspout shoes in accordance with manufacturer's instructions.

3.07 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within 1/8 inch (3 mm) offset of adjoining faces and of alignment of matching profiles.

3.08 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films, if any, as sheet metal roofing is installed. On completion of sheet metal roofing installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

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 SUMMARY

A. This Section includes the following sheet metal flashing and trim:
   1. Formed low-slope roof flashing and trim.

B. Related Sections include the following:
   1. Division 06 Section "Miscellaneous Carpentry" for wood nailers, curbs, and blocking.
   2. Division 07 Section "Sheet Metal Roofing" for factory-formed metal roof panels and flashing and trim not part of sheet metal flashing and trim.
   3. Division 07 Section "Polyvinyl-Chloride (PVC) Roofing" for installing sheet metal flashing and trim integral with roofing membrane.
   4. Division 07 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

1.03 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
   1. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft. (1.48 to 2.15 kPa): 90 lbf/sq. ft. (4.31 kPa) perimeter uplift force, 120 lbf/sq. ft. (5.74 kPa) corner uplift force, and 45 lbf/sq. ft. (2.15 kPa)

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

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.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
   1. Identify material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
   1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, cleats, clips, closures, and other attachments.
   2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
   3. Accessories: Full-size Sample.

1.05 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.07 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.01 SHEET METALS

A. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
   1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
   2. Exposed Finishes: Apply the following coil coating:
      a. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
         1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA 2604, except as modified below:
            (a) Humidity Resistance: 1000 hours.
            (b) Salt-Spray Resistance: 1000 hours.
         2) Color: As selected by Architect from manufacturer's full range.

2.02 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.
   1. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.

C. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.03 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated.
   1. Available Manufacturers:
      a. Cheney Flashing Company, Inc.
      b. Fry Reglet Corporation.
      c. Heckmann Building Products Inc.
      d. Hickman, W. P. Company.
      e. Keystone Flashing Company, Inc.
      f. Sandell Manufacturing Company, Inc.
   2. Material: Galvanized steel, 0.0217 inch thick (Galvanized steel, 0.55 mm thick).
   3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
   4. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
   5. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
   6. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.04 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
   1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
   1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.05 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
   1. Fabricate downspouts from the following material:
      a. Prepainted, Metallic-Coated Steel: 0.0217 inch (0.55 mm) thick.

B. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4 inch (100 mm) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
   1. Fabricate parapet scuppers from the following material:
      a. Prepainted, Metallic-Coated Steel: 0.0276 inch (0.7 mm) thick.

2.06 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96 inch (2400 mm) long, but not exceeding 10 foot (3 m) long, sections. Furnish with 6 inch (150 mm) wide joint cover plates.
   1. Joint Style: Lap, 4 inches (100 mm) wide.
   2. Fabricate with scuppers spaced 10 feet (3 m) apart, of dimensions required with 4 inch (100 mm) wide flanges and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
   3. Fabricate scuppers from the following material:
      a. Prepainted, Metallic-Coated Steel: 0.0276 inch (0.7 mm) thick.

B. Copings: Fabricate in minimum 96 inch (2400 mm) long, but not exceeding 10 foot (3 m) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and solder or weld watertight.
   1. Joint Style: Butt, with 12 inch (300 mm) wide concealed backup plate.
   2. Fabricate copings from the following material:
      a. Prepainted, Metallic-Coated Steel: 0.0396 inch (1.0 mm) thick.

C. Base Flashing: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 0.040 inch (1.016 mm) thick.

D. Counterflashing: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 0.0217 inch (0.55 mm) thick.

E. Flashing Receivers: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 0.0217 inch (0.55 mm) thick.

F. Roof-Penetration Flashing: Fabricate from the following material:
   1. Lead: 4.0 lb/sq. ft. (1.6 mm thick), hard tempered.

2.07 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
   1. Prepainted, Metallic-Coated Steel: 0.0276 inch (0.7 mm) thick.

2.08 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
   1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

C. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
   1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

D. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

E. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.
   1. Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.

F. Seal joints with elastomeric sealant as required for watertight construction.
   1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
   2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

3.03 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Downspouts: Join sections with 1-1/2 inch (38 mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.
   1. Provide elbows at base of downspout to direct water away from building.
   2. Connect downspouts to underground drainage system indicated.

C. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
   1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
   2. Loosely lock front edge of scupper with conductor head.
   3. Seal or solder exterior wall scupper flanges into back of conductor head.

3.04 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24 inch (600 mm) centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.
   1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at 24 inch (600 mm) centers.
   2. Anchor interior leg of coping with screw fasteners and washers at 24 inch (600 mm) centers.

D. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.
   1. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

E. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:
   1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
   2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.05 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.
   1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

C. Preinstallation Conference: Conduct conference at Project site.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.

B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.06 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. A/D Fire Protection Systems Inc.
   2. Grace Construction Products.
   3. Hilti, Inc.
   4. Johns Manville.
   5. Nelson Firestop Products.
   6. Specified Technologies Inc.
   7. 3M Fire Protection Products .
   8. Tremco, Inc.; Tremco Fire Protection Systems Group.
   9. USG Corporation.

2.02 PENETRATION FIRESTOPPING

A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.

B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. Fire-resistance-rated walls include fire walls, fire-barrier walls and fire partitions.
   2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.

C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
   1. Horizontal assemblies include floors and floor/ceiling.
   2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
   3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.

D. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
   1. Permanent forming/damming/backing materials, including the following:
      a. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
      b. Fire-rated form board.
      c. Fillers for sealants.
   2. Temporary forming materials.

3. Substrate primers.
4. Collars.
5. Steel sleeves.

2.03 FILL MATERIALS

A. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.

B. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

C. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.

D. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

E. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.

H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
   1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

2.04 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
   1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
   2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
   3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.03 INSTALLATION

A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
   1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.

C. Install fill materials for firestopping by proven techniques to produce the following results:
   1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
   2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
   3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
   1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
   2. Contractor's name, address, and phone number.
   3. Designation of applicable testing and inspecting agency.
   4. Date of installation.
   5. Manufacturer's name.
   6. Installer's name.

3.05 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

3.06 PENETRATION FIRESTOPPING SCHEDULE

A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."

END OF SECTION

SECTION 07 84 46

FIRE-RESISTIVE JOINT SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes fire-resistive joint systems for the following:
   1. Floor-to-floor joints.
   2. Floor-to-wall joints.
   3. Head-of-wall joints.
   4. Wall-to-wall joints.
   5. Perimeter fire-resistive joint systems consisting of floor-to-wall joints between perimeter edge of fire-resistance-rated floor assemblies and exterior curtain walls.

B. Related Sections include the following:
   1. Section 07 21 00 - Thermal Insulation for floor-to-wall joints indicated as perimeter fire-containment systems between perimeter edge of fire-resistance-rated floor assemblies and back of non-fire-resistance-rated exterior curtain walls.
   2. Section 07 84 13 - Through-Penetration Firestop Systems for systems installed in openings in walls and floors with and without penetrating items.
   3. Section 07 92 00 - Joint Sealants for non-fire-resistive joint sealants.

1.02 PERFORMANCE REQUIREMENTS

A. General: Provide fire-resistive joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of assembly in which fire-resistive joint systems are installed. See details on the Drawings.

B. Joint Systems in and between Fire-Resistance-Rated Constructions: Provide systems with assembly ratings equaling or exceeding the fire-resistance ratings of construction that they join,and with movement capabilities indicated as determined by UL 2079.
   1. Load-bearing capabilities as determined by evaluation during the time of test.

C. Perimeter Fire-Resistive Joint Systems: For joints between edges of fire-resistance-rated floor assemblies and exterior curtain walls, provide systems of type and with ratings indicated below and those indicated in the Fire-Resistive Joint System Schedule at the end of Part 3, as determined by UBC Standard 26-9 and UL 2079.
   1. UL-Listed, Perimeter Fire-Containment Systems: Integrity ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.
   2. OPL-Listed, Perimeter Fire-Barrier Systems: F-ratings equaling or exceeding fire-resistance ratings of floor or floor/ceiling assembly forming one side of joint.

D. For fire-resistive systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each fire-resistive joint system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include fire-resistive joint system design designation of testing and inspecting agency acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.
   1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistive joint system configuration for construction and penetrating items.

C. Product Certificates: For each type of fire-resistive joint system, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Field quality-control test reports.

F. Evaluation Reports: Evidence of fire-resistive joint systems' compliance with current applicble reports of the International Code Council (ICC).

G. Research/Evaluation Reports: For each type of fire-resistive joint system.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

C. Source Limitations: Obtain fire-resistive joint systems, for each kind of joint and construction condition indicated, through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide fire-resistive joint systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
   1. Fire-resistance tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL or another agency performing testing and follow-up inspection services for fire-resistive joint systems acceptable to authorities having jurisdiction.
   2. Fire-resistive joint systems are identical to those tested per methods indicated in Part 1 "Performance Requirements" Article and comply with the following:
      a. Fire-resistive joint system products bear classification marking of qualified testing and inspecting agency.
      b. Fire-resistive joint systems correspond to those indicated by referencing system designations of the qualified testing and inspecting agency.

PART 2 - PRODUCTS

2.01 FIRE-RESISTIVE JOINT SYSTEMS

A. Compatibility: Provide fire-resistive joint systems that are compatible with joint substrates, under conditions of service and application, as demonstrated by fire-resistive joint system manufacturer based on testing and field experience.

B. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by fire-resistive joint system manufacturer and approved by the qualified testing and inspecting agency for systems indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning: Clean joints immediately before installing fire-resistive joint systems to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
   1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of fill materials.

2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with fill materials. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by fire-resistive joint system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent fill materials of fire-resistive joint system from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from fire-resistive joint system materials. Remove tape as soon as possible without disturbing fire-resistive joint system's seal with substrates or damaging adjoining surfaces.

3.03 INSTALLATION

A. General: Install fire-resistive joint systems to comply with Part 1 "Performance Requirements" Article and fire-resistive joint system manufacturer's written installation instructions for products and applications indicated.

B. Install forming/packing/backing materials and other accessories of types required to support fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

C. Install fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings and forming/packing/backing materials as required to achieve fire-resistance ratings indicated.
2. Apply fill materials so they contact and adhere to substrates formed by joints.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.04 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified independent inspecting agency to inspect fire-resistive joint systems and prepare inspection reports.

B. Testing Services: Inspecting of completed installations of fire-resistive joint systems shall take place in successive stages as installation of fire-resistive joint systems proceeds. Do not proceed with installation of joint systems for the next area until inspecting agency determines completed work shows compliance with requirements.
1. Inspecting agency shall state in each report whether inspected fire-resistive joint systems comply with or deviate from requirements.

C. Remove and replace fire-resistive joint systems where inspections indicate that they do not comply with specified requirements.

D. Additional inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Proceed with enclosing fire-resistive joint systems with other construction only after inspection reports are issued and fire-resistive joint systems comply with requirements.

3.05 FIRE-RESISTIVE JOINT SYSTEM SCHEDULE

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.

B. Designation System for Joints at the Intersection of Fire-Resistance-Rated Floor or Floor/Ceiling Assembly and an Exterior Curtain-Wall Assembly: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHDG.

END OF SECTION

SECTION 07 91 00

PREFORMED JOINT SEALS

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. Preformed, foam joint seals.

B. Related Requirements:
   1. Section 07 92 00 "Joint Sealants" for liquid sealants applied over preformed seals in dual seal systems.

1.03 ACTION SUBMITTALS

A. Product Data: For each preformed joint seal product.

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of preformed joint seal required, provide Samples with joint seals in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint seals.

D. Preformed Joint Seal Schedule: Include the following information:
   1. Joint seal location and designation.
   2. Joint width and movement capability.
   3. Joint seal manufacturer and product name.
   4. Joint seal color.

1.04 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each preformed joint seal for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Warranties: For special warranties.

1.05 QUALITY ASSURANCE

A. Mockups: Install mockups of assemblies specified in other Sections that are indicated to receive preformed joint seals specified in this Section. Use materials and installation methods specified in this Section.

1.06 WARRANTY

A. Special Warranty: Installer agrees to repair or replace preformed joint seals that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish preformed joint seals to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PREFORMED, FOAM JOINT SEALS

A. Preformed, Foam Joint Seals: Manufacturer's standard joint seal manufactured from urethane or EVA (ethylene vinyl acetate) foam with minimum density of 10 lb/cu. ft. (160 kg/cu. m) and impregnated with a nondrying, water-repellent agent. Factory produce in precompressed sizes in roll or stick form to fit joint widths based on design criteria indicated, with factory- or field-applied adhesive for bonding to substrates.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. BASF Corp. - Watson Bowman Acme Corp.
      b. EMSEAL Joint Systems, Ltd.
      c. MM Systems Corporation.
      d. Pecora Corporation.
   2. Design Criteria:
      a. Nominal Joint Width: As indicated on Drawings.
      b. Minimum Joint Width: As indicated on Drawings.
      c. Maximum Joint Width: As indicated on Drawings.
      d. Movement Capability: -25 percent/+25 percent.
   3. Joint Seal Color: As selected by Architect from full range of industry colors.

2.02 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by preformed-joint-seal manufacturer for joint substrates indicated.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to preformed joint seal manufacturer, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces and formulated to promote best adhesion to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with preformed joint seals and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive preformed joint seals, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting preformed-joint seal performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing preformed joint seals to comply with preformed joint seal manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of preformed joint seal, including dust, paints (except for permanent protective coatings tested and approved for seal adhesion and compatibility by seal manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimal bond with preformed joint seals. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
   3. Remove laitance and form-release agents from concrete.

4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint seals. Nonporous joint substrates include the following:
   a. Metal.

B. Joint Priming: Prime joint substrates where recommended by preformed joint seal manufacturer or as indicated by tests or prior experience. Apply primer to comply with joint seal manufacturer's written instructions. Confine primers to areas of joint seal bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of adhesive or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION

A. General: Comply with preformed joint seal manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Installation of Preformed, Foam Joint Seals:
   1. Install each length of seal immediately after removing protective wrapping.
   2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
   3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
   4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

3.04 PROTECTION

A. Protect preformed joint seals from damage resulting from construction operations or other causes so seals are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated seals immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

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. This Section includes joint sealants for the applications indicated in the Joint-Sealant Schedule at the end of Part 3.
   1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Control and expansion joints in unit masonry.
      b. Joints between different materials.
      c. Perimeter joints between materials listed above and frames of doors and windows.
      d. Other joints as indicated.
   2. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Perimeter joints of exterior openings where indicated.
      b. Vertical joints on exposed surfaces of partitions.
      c. Perimeter joints between interior wall surfaces and frames of interior doors.
      d. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      e. Other joints as indicated.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.
   2. Division 08 Section "Glazing" for glazing sealants.
   3. Division 09 Section "Gypsum Board" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
   4. Division 09 Section "Ceramic Tile" for sealing tile joints.
   5. Division 09 Section Suspended Acoustical Ceilings for sealing edge moldings at perimeters of acoustical ceilings.

1.03 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2 inch (13 mm) wide joints formed between two 6 inch (150 mm) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
   2. Conduct field tests for each application indicated below:
      a. Each type of elastomeric sealant and joint substrate indicated.
      b. Each type of nonelastomeric sealant and joint substrate indicated.
   3. Notify Architect seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.
         1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

C. Installation Plan: Include schedule of sealed joints, including the following.
   1. Installation Log Form: Include the following data fields, with known information filled out.
      a. Location on project.
      b. Substrates.
      c. Sealant used.
      d. Primer to be used, or indicate as "No primer" used.
      e. Date of installation.
      f. Name of installer.
      g. Actual joint width; provide space to indicate maximum and minimum width.
      h. Actual joint depth to face of backing material at centerline of joint.
      i. Air temperature.

1.06 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (or are below 5 deg C).
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.07 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Final Acceptance.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 10 years from date of Final Acceptance.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
   1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Sealants: 250 g/L.
   2. Sealant Primers for Nonporous Substrates: 250 g/L.
   3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Single-Component Neutral- and Basic-Curing Silicone Sealant:
   1. Products:
      a. Dow Corning Corporation; 790.
      b. Momentive Performance Materials, Inc (formerly GE Silicones); Product SilPruf LM SCS2700: www.momentive.com.
      c. Tremco; Spectrem 1 (Basic).
      d. Pecora Corporation; 890.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 50.
   4. Use Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
   6. Stain-Test-Response Characteristics: Non-staining to porous substrates per ASTM C 1248.

D. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant:
   1. Available Products:
      a. Pecora Corporation; 898.
      b. Tremco; Tremsil 600 White.
   2. Type and Grade: S (single component) and NS (nonsag).
   3. Class: 25.
   4. Use Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

E. Multicomponent Nonsag Urethane Sealant:
   1. Available Products:
      a. Pecora Corporation; Dynatrol II.
      b. Tremco; Dymeric 511.
      c. Tremco; Vulkem 922.
   2. Type and Grade: M (multicomponent) and NS (nonsag).
   3. Class: 50.
   4. Uses Related to Exposure: NT (nontraffic).
   5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
      a. Use O Joint Substrates: color anodic aluminum.

F. Multicomponent Pourable Urethane Sealant:
   1. Products:
      a. Meadows, W. R., Inc.; POURTHANE.
      b. Pecora Corporation; Urexpan NR-200.
      c. Tremco; THC-901.
   2. Type and Grade: M (multicomponent) and P (pourable).
   3. Class: 25.
   4. Use Related to Exposure: T (traffic).
   5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

2.04 LATEX JOINT SEALANTS

A. Latex Sealant: Comply with ASTM C 834, Type P, Grade NF.

B. Products:
   1. Bostik Findley; Chem-Calk 600.
   2. Pecora Corporation; AC-20+.
   3. Sonneborn, Division of ChemRex Inc.; Sonolac.
   4. Tremco; Tremflex 834.

2.05 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:
   1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   2. Products:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.

2.06 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Precast Architectural Concrete.
      b. Masonry.
   3. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.
      c. Glazed surfaces of porcelain tile.

B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
   4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
   5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.
      a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.06 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application JS-1: Exterior vertical control and expansion joints in precast architectural concrete and unit masonry.
   1. Joint Sealant: Multicomponent nonsag urethane sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

B. Joint-Sealant Application JS-2: Exterior perimeter joints between exterior wall and frames of doors and windows.
   1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

C. Joint-Sealant Application JS-3: Interior perimeter joints of exterior openings.
   1. Joint Sealant: Single-component neutral- and basic-curing silicone sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

D. Joint-Sealant Application JS-4: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.
   1. Joint Sealant: Single-component mildew-resistant neutral-curing silicone sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

E. Joint-Sealant Application JS-5: Perimeter joints between interior wall surfaces and frames of interior doors.
   1. Joint Sealant: Latex sealant.
   2. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION

SECTION 07 95 00

EXPANSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Interior expansion control systems.
   2. Exterior wall and horizontal expansion control systems.

B. Related Requirements:
   1. Section 07 84 46 "Fire-Resistive Joint Systems" for liquid-applied joint sealants in fire-resistive building joints.
   2. Section 07 92 00 "Joint Sealants" for liquid-applied joint sealants and for elastomeric sealants without metal frames.

1.02 ACTION SUBMITTALS

A. Shop Drawings: For each expansion control system specified. Include plans, elevations, sections, details, splices, blockout requirement, attachments to other work, and line diagrams showing entire route of each expansion control system. Where expansion control systems change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

B. Samples: For each exposed expansion control system and for each color and texture specified, full width by 6 inches (150 mm) long in size.

C. Samples for Initial Selection: For each type of expansion control system indicated.
   1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.

D. Samples for Verification: For each type of expansion control system indicated, full width by 6 inches (150 mm) long in size.

E. Product Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
   1. Manufacturer and model number for each expansion control system.
   2. Expansion control system location cross-referenced to Drawings.
   3. Nominal joint width.
   4. Movement capability.
   5. Classification as thermal or seismic.
   6. Materials, colors, and finishes.

PART 2 - PRODUCTS

2.01 SYSTEM DESCRIPTION

A. General: Provide expansion control systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
   1. Furnish units in longest practicable lengths to minimize field splicing. Install with hairline mitered corners where expansion control systems change direction or abut other materials.
   2. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion control systems.

2.02 PERFORMANCE REQUIREMENTS

A. Fire-Resistance Ratings: Where indicated, provide expansion control systems with fire barriers identical to those of systems tested for fire resistance per UL 2079 or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Hose Stream Test: Wall-to-wall and wall-to-ceiling systems shall be subjected to hose stream testing.

B. Seismic Performance: Expansion control systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
   2. Component Importance Factor is 1.5.

2.03 INTERIOR EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product : Subject to compliance with requirements, provide products manufactured by Joint Master/In Pro Corporationor a comparable product by one of the following:
   1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
   2. Balco, Inc.
   3. Construction Specialties, Inc.
   4. JointMaster/InPro Corporation. (Basis of Design)
   5. MM Systems Corporation.
   6. Nystrom, Inc.
   7. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Floor-to-Floor (Type EJ-1):
   1. Basis-of-Design Product: Joint Master/In Pro 106 Series Surface Mount as indicated.
   2. Design Criteria:
      a. Movement Capability: +/- 25%.
   3. Type: Cover plate.
      a. Cover-Plate Design: Manufacturer's standard
      b. Metal: Aluminum.
         1) Finish: Mill.

D. Floor-to-Wall (Type EJ-2):
   1. Basis-of-Design Product: Joint Master/In Pro 106 Series Surface Mount as indicated.
   2. Design Criteria:
      a. Movement Capability: +/- 25%.
   3. Type: Cover plate.
      a. Cover-Plate Design: Manufacturer's standard.
      b. Metal: Aluminum.
         1) Finish: Clear anodic, Class II.

E. Wall-to-Wall/Ceiling-to-Ceiling; Wall-to-Corner or Wall-to-Ceiling (Type EJ-3):
   1. Basis-of-Design Product: Joint Master/In Pro 113 Series Recess Mount as indicated.
   2. Type: Cover plate.
      a. Metal: Aluminum.
         1) Finish: Clear anodic, Class II.

2.04 EXTERIOR WALL EXPANSION CONTROL SYSTEMS

A. Basis-of-Design Product : Subject to compliance with requirements, provide products manufactured by EMSEAL Corporation or a comparable product by one of the following:
   1. Architectural Art Mfg., Inc.; Division of Pittcon Industries.
   2. Balco, Inc.
   3. Construction Specialties, Inc.
   4. JointMaster/InPro Corporation.
   5. MM Systems Corporation.
   6. Watson Bowman Acme Corp.; a BASF Construction Chemicals business.

B. Source Limitations: Obtain expansion control systems from single source from single manufacturer.

C. Wall-to-Wall:
   1. Basis-of-Design Product: EmSeal Colorseal
   2. Design Criteria:
      a. Nominal Joint Width: 2 inches unless otherwise indicated.
   3. Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of acrylic-impregnated expanding foam into a unified hybrid sealant system.
   4. Material shall be capable of movements of +25%, -25% (50% total) of nominal material size
   5. Silicone external color facing to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coating. Silicone coating to be available in a range of not less than 26 standard colors for coordination with typical building materials.
   6. Fabrication
      a. Exterior expansion joint system must be supplied precompressed to less than the joint size, packaged in shrink-wrapped lengths (sticks) with a mounting adhesive on one face.
      b. Directional changes and terminations into horizontal plane surfaces shall be provided by factory-manufactured universal-90-degree single units containing minimum 12-inch long leg and 6-inch long leg or custom leg on each side of the direction change or through field fabrication in strict accordance with installation instructions.
   7. Color: Custom color to match adjacent material.

2.05 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard moisture barrier consisting of a continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary cover.

2.06 MATERIALS

A. Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 for extrusions; ASTM B 209 (ASTM B 209M), Alloy 6061-T6 for sheet and plate.

B. Elastomeric Seals: ASTM E 1783; preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Cellular Foam Seals: Extruded, compressible foam designed to function under compression.

D. Moisture Barrier: Flexible elastomeric material, PVC, minimum 30 mils thick.

E. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.07 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.08 ALUMINUM FINISHES

A. Mill finish.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A42, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces where expansion control systems will be installed for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare substrates according to expansion control system manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion control systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion control systems.

C. Cast-In Frames: Coordinate and furnish frames to be cast into concrete.

3.03 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion control systems and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion control systems.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
   2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation. Notify Architect where discrepancies occur that will affect proper expansion control system installation and performance.
   3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
   4. Repair or grout blockout as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
   5. Install frames in continuous contact with adjacent surfaces.
      a. Shimming is not permitted.
   6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals in Metal Frames: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
   1. Provide in continuous lengths for straight sections.
   2. Seal transitions according to manufacturer's written instructions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
   3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Compression Seals: Apply adhesive or lubricant adhesive as recommended by manufacturer to both frame interfaces and sides of slabs before installing compression seals.

E. Foam Seals: Install with adhesive recommended by manufacturer.

F. Terminate exposed ends of expansion control systems with field- or factory-fabricated termination devices.

G. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion control system materials and associated work so complete assemblies comply with assembly performance requirements.
   1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

H. Moisture Barrier: Provide at all exterior joints and where indicated on Drawings. Provide drainage fittings at a maximum of 50 feet (15.2 m) or where indicated on Drawings.

3.04 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion control systems. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections located in the Bid Package Manual, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Standard hollow-metal steel doors.
   2. Standard hollow-metal steel frames.

B. Related Sections include the following:
   1. Division 04 Section "Unit Masonry" for building anchors into and grouting standard steel frames in masonry construction.
   2. Division 08 Section "Wood Doors" for wood doors in standard steel frames.
   3. Division 08 Sections for door hardware for standard steel doors and frames.
   4. Division 09 painting Sections for field painting standard steel doors and frames.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, and finishes for each type of steel frame specified.

B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:
   1. Elevations of each door design.
   2. Frame details for each frame type, including dimensioned profiles.
   3. Details and locations of reinforcement and preparations for hardware.
   4. Details of each different wall opening condition.
   5. Details of anchorages, accessories, joints, and connections.
   6. Details of conduit and preparations for electrified door hardware and controls.

C. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

C. Fire-Rated Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
   1. Test Pressure: Test according to NFPA 252 or UL 10C. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

B. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4 inch (102 mm) high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.
   1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.07 COORDINATION

A. Coordinate installation of anchorages for standard steel frames.. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

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:
   1. Amweld Building Products, LLC.
   2. Ceco Door Products; an ASSA ABLOY Group Company.
   3. CURRIES Company; an ASSA ABLOY Group Company.
   4. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.
   5. Steelcraft; an Ingersoll-Rand Company.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.

D. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

F. Grout: Comply with Division 04 Section "Unit Masonry."

2.03 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
   1. Design: Flush panel.
   2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
      a. Fire Door Core: As required to provide fire-protection ratings indicated.

b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W) when tested according to ASTM C 1363.
   1) Locations: Exterior doors.

3. Vertical Edges for Single-Acting Doors: Beveled edge.
   a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).
4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8 inch (54 mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042 inch (1.0 mm) thick end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
   1. Hinges: Minimum 8 gauge by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
   2. Lock Face Closers, and Concealed Holders: Minimum 14 gauge.
   3. All Other Surface-Mounted Hardware: Minimum 14 gauge.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.04 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
   1. Fabricate frames with mitered or coped and welded face corners and seamless face joints.
   2. Frames for Level 2 Steel Doors: 14 gauge steel sheet, unless otherwise indicated.

C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
   1. Fabricate frames with mitered or coped and welded face corners and seamless face joints, unless otherwise indicated.
   2. Frames for Wood Doors: 16 gauge steel sheet, unless otherwise indicated.
   3. Frames for Level 2 Steel Doors: 16 gauge steel sheet, unless otherwise indicated.

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
   1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
   2. Lock Face Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
   3. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

F. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm)
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

G. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.05 ACCESSORY MATERIALS

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

C. Astragals for Double Doors: Specified in Section 08 71 00.
   1. Fire-Rated Doors: Steel, shape as required to accomplish fire rating.

D. Grout for Frames: Portland cement grout of maximum 4-inch slump for hand troweling.

E. 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.

F. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

2.06 STOPS AND MOLDINGS

A. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.

B. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

2.07 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in doors.

C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
   3. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
   4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

5. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      1) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
   b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      1) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
   1. Reinforce doors and frames to receive non-templated mortised and surface-mounted door hardware.
   2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.

2.08 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish standard steel frames after assembly.

B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

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 standard steel doors and frames.
   1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
   2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap frames to receive nontemplated mortised and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Provide frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Standard Steel Frames: Install standard steel frames for doors, of size and profile indicated. Comply with SDI 105.
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Install door silencers in frames before grouting.
      c. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      d. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
   4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 04 Section "Unit Masonry".
   5. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
c. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

C. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 14 16

WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solid-core doors with wood-veneer faces.
   2. Factory finishing wood doors.
   3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:
   1. Section 08 11 13 "Hollow Metal Doors and Frames" for frames at wood doors.
   2. Section 08 80 00 "Glazing" for glass view panels in wood doors.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
   1. Dimensions and locations of blocking.
   2. Dimensions and locations of mortises and holes for hardware.
   3. Dimensions and locations of cutouts.
   4. Undercuts.
   5. Requirements for veneer matching.
   6. Doors to be factory finished and finish requirements.
   7. Fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.
   2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
      a. Provide Samples for each species of veneer and solid lumber required.
      b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
   3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.04 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eggers Industries.
   2. Graham Wood Doors; an Assa Abloy Group company.
   3. Lambton Doors.
   4. Marshfield Door Systems, Inc.
   5. VT Industries, Inc.

2.02 WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

B. WDMA I.S.1-A Performance Grade: Heavy Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
   1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
   2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
   3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Sound Retardant Doors: Minimum STC of 39, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.

E. Particleboard-Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde.
   2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
      a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.

F. Mineral-Core Doors:
   1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
   2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated asneeded to eliminate through-bolting hardware.
   3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
      a. Screw-Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.

2.03 VENEER-FACED DOORS FOR PAINTED FINISH

A. Interior Solid-Core Doors:
   1. Grade: Custom.
   2. Species: Maple.
   3. Cut: Plain sliced (flat sliced).
   4. Match between Veneer Leaves: Book match.
   5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
   6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
   7. Exposed Verticaland Top Edges: Same species as faces.
   8. Core: Particleboard.
   9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.04 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
   1. Wood Species: Same species as door faces.
   2. Profile: Flush rectangular beads.
   3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.05 FABRICATION

A. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
   1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

B. Openings: Factory cut and trim openings through doors.
   1. Light Openings: Trim openings with moldings of material and profile indicated.
   2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.06 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

B. Factory finish doors.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: WDMA TR-4 Conversion Varnish.
   3. Staining: As selected by Architect from manufacturer's full range.
   4. Effect: Open-grain finish.
   5. Sheen: Satin.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.
   1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
   1. Install fire-rated doors according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.03 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND FRAMES

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. This Section includes the following:
   1. Access doors and frames for ceilings.

B. Related Sections include the following:
   1. Division 08 Section "Door Hardware" for mortise or rim cylinder locks and master keying.
   2. Division 09 Section "Gypsum Board" for ceiling receiving access doors.

1.03 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, materials, individual components and profiles, and finishes.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.05 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.01 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
   2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

D. Drywall Beads: Edge trim formed from 0.0299 inch (0.76 mm) zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.02 ACCESS DOORS AND FRAMES FOR CEILINGS

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:
   1. Babcock-Davis; A Cierra Products Co.
   2. Jensen Industries.
   3. J. L. Industries, Inc.
   4. Karp Associates, Inc.

5. Larsen's Manufacturing Company.
6. Milcor Inc.
7. Nystrom, Inc.

B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet.
1. Locations: Ceiling surfaces.
2. Door: Minimum 0.060 inch (1.5 mm) thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060 inch (1.5 mm) thick sheet metal with drywall bead flange.
4. Hinges: Spring-loaded, concealed-pin type.
5. Latch: Cam latch operated by screwdriver with interior release.
6. Size: 16 x 16 inches unless otherwise indicated.

2.03 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
1. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.02 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 33 13

ROLLING COUNTER DOORS WITH INTEGRAL FRAME

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Manual rolling counter doors with integral frame and countertop, slip-in type.

B. Related Sections:
   1. 05 50 00 Metal Fabrications. Door opening jamb and head members.
   2. 06 10 00 Rough Carpentry. Door opening jamb and head members.
   3. 08 71 00 Door Hardware. Masterkeyed cylinder.

1.02 SUBMITTALS

A. Reference Section 01 33 00 Submittal Procedures; submit the following items:
   1. Product Data.
   2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
   3. Quality Assurance/Control Submittals:
      a. Provide proof of manufacturer ISO 9001:2000 registration.
      b. Provide proof of manufacturer and installer qualifications.
      c. Provide manufacturer's installation instructions.
   4. Closeout Submittals:
      a. Operation and Maintenance Manual.
      b. Certificate stating that installed materials comply with this specification.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: ISO 9001:2000 registered and a minimum of five years experience in producing counter doors with integral frame assembly of the type specified.
   2. Installer Qualifications: Manufacturer's approval.

1.04 DELIVERY STORAGE AND HANDLING

A. Reference Section 01 60 00 Product Requirements.

B. Follow manufacturer's instructions.

1.05 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship.

B. Maintenance: Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Alpine Overhead Doors, Inc.

B. C.H.I. Overhead Doors, Inc.

C. Clopay Building Products; Product CESC20 (Basis of Design).

D. Cookson Company.

E. ENTREMATIC.

F. McKeon Rolling Steel Door Company, Inc.

G. Overhead Door Corporation.

H. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
   1. Include tamperproof cycle counter.

2.02 MATERIALS

A. Curtain:
   1. Slats: No. 1F, interlocked flat-faced slats, 1-1/2 inches high by 1/2 inch deep, 22 gauge ASTM A 653, Commercial Quality, galvanized steel with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal.
   2. Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats.
   3. Slat Finish:
      a. GalvaNex Coating System and phosphate treatment followed by baked-on polyester powder coat, color as selected by Architect from manufacturer's standard color range, minimum 32 colors; minimum 2.5 mils cured film thickness; ASTM D-3363 pencil hardness: H or better.
   4. Bottom Bar Finish:
      a. Aluminum Bar/Steel Slat with Powder Coating: Match slat powder coating.

B. Head and Jamb Frame: Integral welded with guide groove incorporated into jamb design. Build to fit wall thickness.
   1. Steel: 16 gauge formed shapes
   2. Finish:
      a. Steel: Light gray shop prime coat; minimum 0.6 mils cured film thickness.

C. Countertop: Integral 14 gauge AISI 300 series stainless steel formed shape; No. 4 finish.

D. Counterbalance Shaft Assembly:
   1. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot of width.
   2. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs. Provide wheel for applying and adjusting spring torque.

E. Brackets: Fabricate from reinforced [steel] [AISI 300 series stainless steel] plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures for hood.
   1. Finish:
      a. Steel: Light gray shop prime coat; minimum 0.6 mils (0.015 mm) cured film thickness.
      b. Stainless Steel: No. 4 finish.

F. Hood and Fascia: 16 gauge steel with reinforced top and bottom edges.
   1. Finish:
      a. Steel: Light gray shop prime coat; minimum 0.6 mils (0.015 mm) cured film thickness.

2.03 ACCESSORIES

A. Locking:
   1. Lockable slide bolt on coil side of bottom bar at each jamb extending into slots in guides.
   2. Masterkeyable cylinder operable from both sides of bottom bar.

2.04 FABRICATION

A. Factory weld head, jambs and countertop into single unit, fully assembled, ready for installation.

2.05 OPERATION

A. Manual Push-Up: Provide lift handles on bottom bar and pole with hook.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Commencement of work by installer is acceptance of substrate.

3.02 INSTALLATION

A. General: Install door unit and operating equipment with necessary hardware, anchors, inserts, hangers and supports.

B. Follow manufacturer's installation instructions.

3.03 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion.

3.04 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.05 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative.

B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Insulated service doors.
   2. Fire rated doors.

B. Related Requirements:
   1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports.

1.02 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.
   1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
   3. Include description of automatic closing device and testing and resetting instructions.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.
   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
   4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
   5. Show locations of controls, locking devices, and other accessories.
   6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
   1. Include similar Samples of accessories involving color selection.

D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
   1. Curtain slats.
   2. Bottom bar with sensor edge.
   3. Guides.
   4. Brackets.
   5. Hood.
   6. Locking device(s).
   7. Include similar Samples of accessories involving color selection.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Oversize Construction Certification: For door assemblies required to be fire-rated and that exceed size limitations of labeled assemblies.

C. Operational wind load certification as specified in paragraph 2.02A4.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
   1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
   1. Temperature-Rise Limit: Where indicated, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
   2. Smoke Control: Where indicated, provide doors that are listed and labeled with the letter "S" on the fire-rating label by a qualified testing agency for smoke- and draft-control based on testing according to UL 1784; with maximum air-leakage rate of 3.0 cfm/sq. ft. (0.01524 cu. m/s x sq. m) of door opening at 0.10-inch wg (24.9 Pa) for both ambient and elevated temperature tests.

PART 2 - PRODUCTS

2.01 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.
   1. Obtain operators and controls from overhead coiling door manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance, Exterior Doors: Capable of withstanding the design wind loads.
   1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa), acting inward and outward.
   2. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
   3. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 10 lbf/sq. ft. (480 Pa) wind load, acting inward and outward. Manufacturer shall engage an independent test laboratory to certify the specified operational wind load.

2.03 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Cookson Company.
      b. Cornell Iron Works, Inc.
      c. McKeon Rolling Steel Door Company, Inc.

B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Air Infiltration: Maximum rate of 0.13 cfm/sq. ft. at 15 and 0.217 cfm/sq. ft. at 25 when tested according to ASTM E 283 or DASMA 105.

D. Curtain R-Value: 5.0 deg F x h x sq. ft./Btu (0.881 K x sq. m/W).

E. Door Curtain Material: Galvanized steel.

F. Door Curtain Slats: Flat profile slats of 2-5/8-inch (67-mm) center-to-center height.
   1. Insulated-Slat Interior Facing: Metal.
   2. Continuous endlocks on ends of each slat and roller windlocks as required to achieve an operational wind load.

G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from structural steel and powder coat finished to match door.

H. Curtain Jamb Guides: Steel with powder coat finish matching curtain slats.

I. Hood: Match curtain material and finish.
   1. Shape: As shown on Drawings.
   2. Mounting: Face of wall unless otherwise indicated.

J. Locking Devices: Equip door with locking device assembly.
   1. Locking Device Assembly: Single-jamb side locking bars, operable from inside and outside with cylinders.

K. Electric Door Operator:
   1. Usage Classification: Light duty, up to 10 cycles per hour.
   2. Operator Location: Top of hood.
   3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet (2.44 m) or lower.
   4. Motor Exposure: Interior.
   5. Emergency Manual Operation: Chain type.
   6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar; self-monitoring type.
      a. Sensor Edge Bulb Color: Black.
   7. Control Station(s): Interior mounted.
   8. Other Equipment: Audible and visual signals.

L. Curtain Accessories: Equip door with weatherseals.

M. Door Finish:
   1. Powder-Coated Finish: As selected by Architect from manufacturer's full range.
   2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.04 FIRE-RATED DOOR ASSEMBLY

A. Fire-Rated Service Door: Overhead fire-rated coiling door formed with curtain of interlocking metal slats.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      a. Alpine Overhead Doors, Inc.
      b. Cookson Company. (Basis of Design)
      c. Cornell Iron Works, Inc.
      d. McKeon Rolling Steel Door Company, Inc.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
   1. Include tamperproof cycle counter.

C. Fire Rating: As indicated.

D. Door Curtain Material: Galvanized steel.

E. Door Curtain Slats: Flat profile slats of 2-5/8-inch (67-mm) center-to-center height.

F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

G. Hood: Match curtain material and finish.
   1. Shape: Round.
   2. Mounting: Face of wall.

H. Operation
   1. All motor operated fire doors shall have model FDO-A motor operator which shall become operational upon the activation of a fire alarm or smoke detection system or interruption of power to the motor operator. The door shall have a closing speed of not less than six (6) inches per second and not more than twenty-four (24) inches per second as outlined in NFPA Bulletin 80. Once the door has closed, it can be reset by resuming power to the motor operator, clearing the alarm system and pushing the up control station. Mechanical resetting shall never be required.
   2. The door shall be operated at a speed of 2/3 foot per second by an open drip-proof electric motor with gear reducer in oil bath. The motor operator shall include a geared limit switch. The motor starter shall be housed in a NEMA 1 housing and include a 24 volt control transformer, a solid state control circuit board, and complete terminal strip to facilitate field wiring. The motor shall be size as required by the door. The motor operator shall be mounted to the door bracket. Motor operator and controls shall be U.L. listed for use with fire doors.
   3. The fire door shall include the Featheredge rolling door safety edge system as manufactured by The Cookson Company and shall include the following features.
      a. The Featheredge shall be installed on the bottom bar of the door and shall automatically reverse the door if the device detects an obstruction in the downward travel of the door.
      b. The Featheredge shall consist of a rubber boot attached below the bottom bar with an electrical switch secured to the back of the bottom bar. The Featheredge shall operate with air wave technology and shall not rely on pneumatic pressure or electrical strip contacts to operate properly. The Featheredge shall create an air wave that shall be detected and reverse the direction of the rolling door.
      c. The operation of the Featheredge shall not be subject to interferences by temperature, barometric pressure, water infiltration, or cuts in the rubber boot.
      d. The Featheredge shall be connected to the motor operator with a coil cord and take-up reel.
   4. Fire doors shall be controlled by Cookson Model FDO-A motor operator with Test-A-Fire Logic. This motor operator shall allow for the testing of fire doors without ever mechanically resetting the release mechanism. The motor and controls shall be U.L. approved for use with fire doors. The control panel shall be wired directly into the building's 110 volt AC fire alarm or smoke detector system.
      a. Upon activation of the alarm system, the motor operator shall power close the door. If there is an obstruction in the opening, the door shall automatically open and close again. The Featheredge shall continue to cycle the door up and down until the obstruction is removed and the door can fully close or the door has cycled 3 times, in which case the door shall stop on the obstruction. If at any time the obstruction is removed, with the continuation of the alarm signal, the door will
         1) continue to a fully closed position. To reset the door, push the up control station. The door shall return to the fully open position.
      b. If power to the motor operator is interrupted, the automatic closing device shall close the door. The motor operator shall not be mechanically disconnected from the door.
      c. To reset the fire door, resume power to the motor operator, clear the alarm system and push the up control station. The fire door shall never need to be mechanically reset and testing can be performed by any individual by activating the alarm system or by interrupting power to the motor operator.

I. Electric operation.

J. Mounting: Surface mounted.

K. Curtain Accessories: Equip door with smoke seals and pull-down strap.

L. Door Finish:
   1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.

2.05 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.06 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
   1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 (Z275) zinc coating; nominal sheet thickness (coated) of 20 gage (0.035inch), minimum; and as required.
   2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
   3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum steel thickness of 22 gage 0.028 inch, minimum.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding roller windlocks.

2.07 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
   1. Galvanized Steel: Nominal 0.028-inch- (0.71-mm-) thick, hot-dip galvanized steel sheet with G90 (Z275) zinc coating, complying with ASTM A 653/A 653M.

2.08 LOCKING DEVICES

A. Locking Device Assembly: Fabricate with cylinder lock to engage the jambs of the rolling steel door.
   1. Lock Cylinders: Cylinders specified in Section 08 71 00 "Door Hardware" and keyed to building keying system.

2.09 CURTAIN ACCESSORIES

A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
   1. At door head, use 1/8-inch- (3-mm-) thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
   2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- (3-mm-) thick seals of flexible vinyl, rubber, or neoprene.

2.10 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. (2.5 mm/m) of span under full load.

C. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

D. Brackets: Manufacturer's standard mounting brackets of minimum 1/4 inch thickness cold-rolled steel plate.

2.11 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Comply with coating manufacturer's written instructions for cleaning and prepping for coating installation. Provide powder coat finish of color as selected by Architect from manufacturer's standard RAL powder coat selection chart.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Fire-Rated Doors: Install according to NFPA 80.

E. Power-Operated Doors: Install according to UL 325.

3.03 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Perform installation and startup checks according to manufacturer's written instructions.
   2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
   1. Adjust exterior doors and components to be weather-resistant.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION

SECTION 08 34 93

AUTOMATIC OVERHEAD COILING FABRIC FIRE CURTAIN

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fire alarm or smoke detector-activated, overhead coiling fabric fire curtain.
   2. Self-closing without auxiliary power.

B. Related Requirements:
   1. Division 26 Sections for 120VAC (10 amp service with disconnect) and control circuit power including conduit, boxes, conductors, wiring devices, and emergency power.
   2. Division 28: Provision of smoke detectors.

1.02 REFERENCES

A. NFPA Codes and Standards:
   1. 70 - National Electrical Code.
   2. 72 - National Fire Alarm Code-2007, 2010 and 2013.
   3. ASTM - E84 - Test Method for Surface Burning Characteristics of Building Materials

B. UL Standards:
   1. 268 - Smoke detectors for fire protective signaling systems.
   2. 864 - Control units for fire protective signaling systems.
   3. 10B - Fire test for door assemblies.
   4. 10D - Fire test for fire resistant curtains.
   5. 1784 - Air leakage test

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures:
   1. Product data.
   2. Shop drawings:
      a. Include opening dimensions.
      b. Show and identify related work performed under other sections of the specifications.
      c. Quality Assurance/Control Submittals:
   3. Certifications.
   4. Manufacturer’s installation instructions and testing procedures.

1.04 CLOSEOUT SUBMITTALS

A. Comply with Section 01 77 00 - Project Closeout:
   1. Operation and maintenance manual.
   2. Manufacturer’s warranty.

1.05 QUALITY ASSURANCE

A. Certifications:
   1. ETL Listing to UL standards:
      a. 864 - Control units for fire protective signaling systems.
      b. 268 - Smoke detectors for fire protective signaling systems.
      c. 10D - Fire test for fire resistant curtains.
      d. 1784 - Air leakage test

B. Pre-Installation Meeting:
   1. Schedule and convene a pre-installation meeting prior to commencement of field operations with representatives of the following in attendance: Owner, Architect, General Contractor, fire curtain sub-contractor, and electrical sub-contractor.

2. Review substrate conditions, requirements of related work, installation instructions, storage and handling procedures, and protection measures.
3. Document responsibilities of various parties and deviations from specifications and installation instructions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Comply with Section 01 60 00 - Product Requirements.

B. Comply with manufacturer's instructions.

1.07 WARRANTY

A. Provide manufacturer's standard one year warranty.

B. Maintenance and Testing:
1. Perform minimum semi-annual maintenance and testing on each fire curtain as required by the manufacturer's warranty, code agency evaluation reports, and as required by local authority having jurisdiction.
2. Provide test documentation.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Model M2100.

B. Manufacturer:
1. Smoke Guard, Inc.
2. Distributed by Smoke Guard, 287 N. Maple Grove, Boise, Idaho 83704 www.smokeguard.com/

C. Label each fire curtain with following information:
1. Manufacturer's name.
2. Label of quality control agency.

2.02 PERFORMANCE / DESIGN CRITERIA

A. Test normal and fire operation: Curtain to deploy on activation of building fire alarm system signal or test key switch. Curtain shall descend and rewind by motor drive.
1. Raise curtain after test and after fire alarm is cleared.
2. Reset curtain after test or operation of unit using key switch. No manual reset required. No service call needed. No replacement parts needed.

B. Test to 6,000 cycles.

2.03 COMPONENTS

A. Curtain Fabric: SG Tex 30 - Glass fiber material coated on one side with a polyester polyurethane latex and steel wire reinforcement.
1. Rating: 120 minutes.

B. Side Guide Assembly: Manufacturer's standard.

C. Housing/Bearing Type: Standard or support bearing.

D. Bottom Bar: Weighted for self-closing by gravity.

E. Rewind Motor:
1. Tubular motor with fail safe gravity deploy operation.
2. 24 VDC.

F. Control System:
1. Comply with UL Standard 864.
2. Battery backup supplied with the controls.
3. 120 VAC.

G. Finishes:
   1. Manufacturer's standard galvanized finish.

2.04 FABRICATION

A. Installation Configuration: Housing attached directly to substrate above opening or to wall.

B. Fabricate and install mounting brackets, hardware, and fasteners needed to attach fire curtain assembly to building structure.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates upon which work will be installed.
   1. Verify related work performed under other sections is complete and in accordance with shop drawings.
   2. Verify wall surfaces are acceptable for installation of fire curtain system components.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Coordinate electrical interface and connection with Division 26.

D. Coordinate interface and connection with fire and alarm system.

E. Commencement of work by installer is acceptance of substrate.

3.02 INSTALLATION

A. Install fire curtain system components in accordance with manufacturer's installation instructions.

3.03 FIELD QUALITY CONTROL

A. Field Test: Follow manufacturer's cycle test procedures.
   1. Notify Owner's Representative, local Fire Marshal and alarm sub-contractor minimum one week in advance of scheduled testing.
   2. Complete maintenance service record.

3.04 DEMONSTRATION

A. Demonstrate required testing and maintenance procedures to Owner's Representative.

END OF SECTION

SECTION 08 38 15

DOUBLE-ACTING TRAFFIC DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Double-acting self-closing swinging traffic doors.

B. Door accessories.

C. Door frames.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Wall-mounted door stops.

1.03 SUBMITTALS

A. Product Data: Manufacturer's technical information for each type of door specified, including details about materials, components, profiles, gaskets, and finishes; include:
   1. Preparation and installation instructions and methods.
   2. Storage and handling requirements and recommendations.
   3. Operation and maintenance data.

B. Shop Drawings: Show installation details of doors and frames, including elevations and attachment.

C. Selection Samples: For each finish requiring color selection, submit color samples indicating full line of available colors and finishes.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver product in manufacturer's original unopened packages with label legible and intact.

B. Store doors at project site on edge or in upright position, under cover and elevated above grade, following manufacturer's instructions.

1.05 WARRANTY

A. Provide two year manufacturer warranty from date of Final Acceptance for molded polyethylene doors against damage due to worker-ridden vehicle traffic; state limitations in executed warranty.

PART 2 - PRODUCTS

2.01 TRAFFIC DOORS

A. Thermoplastic Double-Acting Traffic Doors : Hollow core ABS, polyvinyl chloride, or polyethylene with urethane foam fill.
   1. Thickness: 1-7/8 inches (48 mm).
   2. Faces: 1/8 inch (3 mm) minimum thickness; textured or pebble finish.
   3. Construction: Manufacturer's standard construction with faces bonded to thermoplastic subframe or molded in one piece, reinforced for durability and rigidity, with all edges, cut-outs, and hardware preparations factory fabricated; provide view window cut-outs with joints sealed independently of glazing or trim.
   4. Hardware Preparations: Factory reinforce, machine, and prepare for all hardware including field installed items; provide solid blocking for each hardware item; make field cutting, drilling or tapping unnecessary.
   5. Gaskets: Replaceable rubber gaskets in key on edge of door.
   6. Color: As selected by Architect from manufacturer’s full range.

7. Manufacturers:
   a. Chase Doors: www.chasedoors.com.
   b. Eliason Corporation: www.eliasoncorp.com.
   c. Rubbair Door, Inc: www.rubbair.com.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Door Assemblies: Provide double-acting, self-closing pairs of doors ; factory fabricated and finished, complete with hinges and specified accessories.
   1. Door Swing: Minimum of 90 degrees each direction.
   2. Hinges: V-cam gravity hinges at top and pivots at bottom; mounted on bottom of header and on jamb; maximum rise 1-1/2 inches (38 mm); vertical adjustment in the field.
   3. Hinge Guards: Manufacturer's standard material and configuration, to protect lower hinges from damage.
   4. Exposed Metal Parts: Either stainless steel.
   5. View Windows: Provide view window in each door panel unless otherwise indicated, centered in door width, and 48 inches (1220 mm), maximum, from finish floor to bottom of viewing area.
   6. Dimensional Tolerances: Plus or minus 1/4 inch (6 mm) in width and height of each panel.

C. View Windows: Factory installed glazing in molded or extruded black thermoplastic or rubber gasket; centered in door width; use single glazing unless otherwise indicated.
   1. Square-Shaped Window Size: 12 inches (305 mm) by 16 inches (406 mm).
   2. Single Glazing: Polycarbonate glazing sheet, 1/4 inch (6 mm) thick, clear.

D. Door Gaskets: Manufacturer's standard configuration.
   1. Thermal Gaskets: 55 to 70 durometer extruded black santoprene.
   2. Other Gaskets: Santoprene or PVC.

E. Impact Plates: Surface applied; factory installed.
   1. Push Plates: 12 inches (305 mm) high by 12 inches (305 mm) wide, mounted at leading edge of door with centerline at 48 inches (1220 mm) above floor.
   2. Stainless Steel: Type 304, with No.4 brushed satin finish; 18 gage, 0.0500 inch (1.27 mm) minimum base metal thickness.

2.02 ACCESSORY COMPONENTS

A. Frames: Provide doors pre-hung in frames by door manufacturer; tubular steel welded frame.

B. Jamb Protection: Formed thermoplastic; channel-shaped to fit frames; full height of jambs.

C. Provide tamper proof fasteners and other hardware as recommended by manufacturer for complete installation.

D. Additional Door Hardware: Specified in Section 08 71 00.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that jambs and frames are square and plumb.

B. Verify that opening is ready to receive work and opening dimensions and clearances are as indicated on drawings.

C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory conditions before proceeding.

D. Commencement of work by installer is acceptance of opening conditions.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

3.03 INSTALLATION

A. Install doors with clearances, anchors, hardware, and accessories according to the manufacturer's instructions and as specified.

B. Install doors plumb, level, and properly aligned.

3.04 ADJUSTING

A. Clean and lubricate operating parts.

B. Adjust doors to open and close smoothly and freely without binding and for proper fit of seals.

3.05 CLEANING

A. Clean surfaces using methods as recommended by manufacturer.

3.06 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior storefront framing.
   2. Exterior manual-swing entrance doors and door-frame units.

1.02 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

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.

B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
   1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
   2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.
   3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:
   1. Joinery, including concealed welds.
   2. Anchorage.
   3. Expansion provisions.
   4. Glazing.
   5. Flashing and drainage.

E. Delegated-Design Submittal: For aluminum-framed entrances and storefronts indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
   1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

C. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.

D. Source quality-control reports.

E. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
   1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.07 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.
   2. Warranty Period: Five years from date of Final Acceptance.

B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
      b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Warranty Period: 10 years from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrances and storefronts. Submitted design shall be signed and sealed by professional engineer licensed in North Carolina.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Aluminum-framed entrances shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failure also includes the following:
      a. Thermal stresses transferring to building structure.
      b. Glass breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Failure of operating units.

C. Structural Loads:
   1. Wind Loads: As indicated on Drawings.

D. Deflection of Framing Members: At design wind pressure, as follows:
   1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m) or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19.1 mm), whichever is less.
   2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

E. Structural: Test according to ASTM E 330 as follows:
   1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
   2. When tested at percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
   3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
   1. Fixed Framing and Glass Area:
      a. Maximum air leakage of 0.06 cfm/sq. ft. (0.30 L/s per sq. m) at a static-air-pressure differential of 6.24 lbf/sq. ft. (300 Pa).
   2. Entrance Doors:
      a. Pair of Doors: Maximum air leakage of 1.0 cfm/sq. ft. (5.08 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).
      b. Single Doors: Maximum air leakage of at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

G. Wind Pressure: 23 psf (Zone 5) and 26 psf (Zone 5).

H. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
   1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 12 lbf/sq. ft. (576 Pa).

I. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

J. Energy Performance: Certify and label energy performance according to NFRC as follows:
   1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.57 Btu/sq. ft. x h x deg F (3.23 W/sq. m x K) as determined according to NFRC 100.
   2. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 36 as determined according to NFRC 500.

K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.02 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Trifab VersaGlaze 451TCG113 Ultra Heavy Vertical Mullion entrance doors and storefront manufactured by Kawneer North America or comparable product by one of the following:
   1. Oldcastle Building Envelope.
   2. United States Aluminum.
   3. YKK AP America Inc.

B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.03 FRAMING

A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction (Exterior): Thermally broken.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: Center.
   4. Finish: Factory painted.
   5. Fabrication Method: Field-fabricated stick system.

B. Mullions: Kawneer 451TCG113.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with non-staining, nonferrous shims for aligning system components.

E. Sill Flashings: High Performance Extruded Sill Flashing.

F. Materials:
   1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
      a. Sheet and Plate: ASTM B 209 (ASTM B 209M).
      b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
      c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
      d. Structural Profiles: ASTM B 308/B 308M.

2.04 ENTRANCE DOORS

A. Entrance Doors: Manufacturer's 451TCG113 glazed entrance doors for manual-swing operation matching storefront system.
   1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
      a. Thermal Construction for Exterior Doors: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
   2. Door Design: Medium stile (Vertical and Top Rails: 3-1/2 inches; Bottom Rail: 7-1/2 inches) unless otherwise indicated.
   3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide nonremovable glazing stops on outside of door.

2.05 ENTRANCE DOOR HARDWARE

A. Entrance Door and Operable Panel Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

B. Cylinders: As specified in Section 08 71 00 "Door Hardware."

C. Weather Stripping: Manufacturer's standard replaceable components.
   1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.

D. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch (12.7 mm).

2.06 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Sealants: Comply with Section 08 80 00 "Glazing."

C. Sealants used inside the weatherproofing system shall have a VOC content of 250.

2.07 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
   1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

2.08 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using screw-spline system .

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors and panels as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.09 ALUMINUM FINISHES

A. High-Performance Organic Finish: Two-coat fluoropolymer finish complying with AAMA 2604 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Color and Gloss: As selected by the Architect to match existing finish.

2.10 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C 1401 recommendations including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

3.03 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
   6. Seal perimeter and other joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
   2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Set continuous sill members and flashing in full sealant bed as specified in Section 079200 "Joint Sealants" to produce weathertight installation.

D. Install components plumb and true in alignment with established lines and grades.

E. Install glazing as specified in Section 08 80 00 "Glazing."

F. Install weatherseal sealant according to Section 07 92 00 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.

3.04 ERECTION TOLERANCES

A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
   1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
   2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
      c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.05 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

END OF SECTION

SECTION 08 45 00

TRANSLUCENT WALL AND ROOF ASSEMBLIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Self supporting aluminum framed vertical glazing system.

B. Sandwich panels of translucent skins separated with an aluminum grid.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between perimeter frame and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA CW-DG-1 - Aluminum Curtain Wall Design Guide Manual.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

H. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

1.04 SUBMITTALS

A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, panel configuration, internal drainage details.

B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, weep drainage network, expansion and contraction joint location and details, and field welding required.

C. Samples: Submit two samples, 12 by 12 inch (305 by 305 mm) in size, illustrating prefinished aluminum surface, specified panel with skins, glazing materials illustrating edge and corner.

D. Design Data: Show structural and physical characteristics, engineering calculations, and dimensional limitations.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with AAMA CW-DG-1.

B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect prefinished aluminum surfaces with wrapping; do not use adhesive papers or sprayed coatings that bond when exposed to sunlight or weather.
   1. Puncture wrappings at ends for ventilation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Sandwich Panel Translucent Wall and Roof Assemblies Manufacturers:
   1. Kalwall: www.kalwall.com/#sle.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. System Design: Design and size components to withstand dead loads and live loads caused by snow, hail, and positive and negative wind loads acting on plane of panel without damage or permanent set.
   1. Design Loads: Calculate in accordance with applicable code.
   2. Measure performance in accordance with ASTM E330/E330M, using test load of 1.5 times the design wind pressure and 10 second duration of maximum load.

B. Deflection: Limit mullion deflection to 3/4 inch (19 mm) with full recovery of glazing materials.

C. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min sq ft (0.30 L/sec sq m) of sloped glazed area, measured at a reference differential pressure across assembly of 1.57 psf (75 Pa) as measured in accordance with ASTM E283.

D. Water Leakage: None, when measured in accordance with ASTM E331 at a test pressure difference of 2.86 lbf/sq ft (140 Pa).

E. Expansion / Contraction: System to provide for expansion and contraction within system components caused by a cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components.

F. System Internal Drainage: Drain water entering joints, condensation occurring in framing system, or migrating moisture occurring within system, to the exterior by a weep drainage network.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Fasteners: Stainless steel.

2.04 COMPONENTS

A. Translucent Wall and Roof System: Structurally reinforced translucent panels, with self supporting framing, shop fabricated, factory prefinished, battens, cap strips, related flashings, anchorage and attachment devices.

B. Panels: Bonded to both sides of structural extruded aluminum grid of pattern as indicated; exposed surfaces of exterior sheet chemically and permanently treated to protect against surface erosion and extreme weather conditions.
   1. Facing Sheets: Translucent.
   2. Color as selected by Architect.

C. Sealant for Within Translucent Assembly: As required by manufacturer.

D. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, and compatible with flashing material.

2.05 FABRICATION

A. Fabricate system components with minimum clearances and shim spacing around perimeter of assembly, and ensure proper installation and dynamic movement of perimeter seals.

B. Accurately fit and secure joints and corners. Make joints flush and hairline.

C. Prepare components to receive fabricated anchor devices.

D. Locate fasteners and attachments to ensure concealment from view.

E. Reinforce framing members for external imposed loads.

2.06 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Color: To be selected by Architect from manufacturer's full range.

C. Concealed Steel Items:
   1. Galvanized in accordance with requirements of ASTM A123/A123M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify wall openings and adjoining air barrier and vapor retarder materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install translucent panel system with cells vertical in accordance with manufacturer instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances and align with adjacent work.

E. Install sill flashings.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft (1.5 mm/m) non-cumulative or 0.5 inches per 100 ft (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Panel System Members and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.04 CLEANING

A. Remove protective material from prefinished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths; remove dirt from corners and wipe surfaces clean.

3.05 PROTECTION

A. Protect finished work from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 71 00 – DOOR HARDWARE

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. Mechanical and electrified door hardware for:

a. Swinging doors.
b. Sliding doors.
c. Gates.

2. Electronic access control system components, including:

a. Biometric access control reader.
b. Electronic access control devices.

3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
4. Lead-lining door hardware items required for radiation protection at door openings.

B. Exclusions: Unless specifically listed in hardware sets, hardware is not specified in this section for:

1. Windows
2. Cabinets (casework), including locks in cabinets
3. Signage
4. Toilet accessories
5. Overhead doors

C. Related Sections:

1. Division 01 Section “Alternates” for alternates affecting this section.
2. Division 07 Section “Joint Sealants” for sealant requirements applicable to threshold installation specified in this section.
3. Division 09 sections for touchup finishing or refinishing of existing openings modified by this section.
4. Division 13 Section “Radiation Protection” for requirements for lead-lining for door hardware at openings indicated to receive radiation protection.
5. Division 26 sections for connections to electrical power system and for low-voltage wiring.
6. Division 28 sections for coordination with other components of electronic access control system.

1.03 REFERENCES

A. UL - Underwriters Laboratories

1. UL 10B - Fire Test of Door Assemblies
2. UL 10C - Positive Pressure Test of Fire Door Assemblies
3. UL 1784 - Air Leakage Tests of Door Assemblies
4. UL 305 - Panic Hardware

B. DHI - Door and Hardware Institute

1. Sequence and Format for the Hardware Schedule
2. Recommended Locations for Builders Hardware
3. Key Systems and Nomenclature

C. ANSI - American National Standards Institute

1. ANSI/BHMA A156.1 - A156.29, and ANSI/BHMA A156.31 - Standards for Hardware and Specialties

D. 2016 State of California Building Code

1.04 SUBMITTALS

A. General:

1. Submit in accordance with Conditions of Contract and Division 01 requirements.
2. Highlight, encircle, or otherwise specifically identify on submittals deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
3. Prior to forwarding submittal, comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, “EXAMINATION” article, herein.

B. Action Submittals:

1. Product Data: Product data including manufacturers’ technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:

a. Wiring Diagrams: For power, signal, and control wiring and including:
1) Details of interface of electrified door hardware and building safety and security systems.
2) Schematic diagram of systems that interface with electrified door hardware.
3) Point-to-point wiring.
4) Risers.

3. Samples for Verification: If requested by Architect, submit production sample or sample installations of each type of exposed hardware unit in finish indicated, and tagged with full description for coordination with schedule.

a. Samples will be returned to supplier in like-new condition. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.

4. Door Hardware Schedule: Submit schedule with hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule as published by the Door and Hardware Institute. Indicate complete designations of each item required for each door or opening, include:

   a. Door Index; include door number, heading number, and Architects hardware set number.
   b. Opening Lock Function Spreadsheet: List locking device and function for each opening.
   c. Type, style, function, size, and finish of each hardware item.
   d. Name and manufacturer of each item.
   e. Fastenings and other pertinent information.
   f. Location of each hardware set cross-referenced to indications on Drawings.
   g. Explanation of all abbreviations, symbols, and codes contained in schedule.
   h. Mounting locations for hardware.
   i. Door and frame sizes and materials.
   j. Name and phone number for local manufacturer's representative for each product.
   k. Operational Description of openings with any electrified hardware (locks, exits, electromagnetic locks, electric strikes, automatic operators, door position switches, magnetic holders or closer/holder units, and access control components). Operational description should include how door will operate on egress, ingress, and fire and smoke alarm connection.
      1) Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work that is critical in Project construction schedule.

5. Key Schedule:

   a. After Keying Conference, provide keying schedule listing levels of keying as well as explanation of key system's function, key symbols used and door numbers controlled.
   b. Use ANSI/BHMA A156.28 “Recommended Practices for Keying Systems” as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
   c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
   d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
   e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion.
      1) Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.

   f. Prepare key schedule by or under supervision of supplier, detailing Owner’s final keying instructions for locks.

6. Templates: After final approval of hardware schedule, provide templates for doors, frames and other work specified to be factory prepared for door hardware installation.

C. Informational Submittals:

1. Qualification Data: For Supplier, Installer and Architectural Hardware Consultant.
2. Product Certificates for electrified door hardware, signed by manufacturer:

    a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

3. Certificates of Compliance:

    a. Certificates of compliance for fire-rated hardware and installation instructions if requested by Architect or Authority Having Jurisdiction.
    b. Installer Training Meeting Certification: Letter of compliance, signed by Contractor, attesting to completion of installer training meeting specified in “QUALITY ASSURANCE” article, herein.
    c. Electrified Hardware Coordination Conference Certification: Letter of compliance, signed by Contractor, attesting to completion of electrified hardware coordination conference, specified in “QUALITY ASSURANCE” article, herein.

4. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by qualified testing agency, for door hardware on doors located in accessible routes.
5. Warranty: Special warranty specified in this Section.

D. Closeout Submittals:

1. Operations and Maintenance Data : Provide in accordance with Division 01 and include:

    a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
    b. Catalog pages for each product.
    c. Name, address, and phone number of local representative for each manufacturer.
    d. Parts list for each product.
    e. Final approved hardware schedule, edited to reflect conditions as-installed.
    f. Final keying schedule
    g. Copies of floor plans with keying nomenclature
    h. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
    i. Copy of warranties including appropriate reference numbers for manufacturers to identify project.

1.05 QUALITY ASSURANCE

A. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.

1. Where specific manufacturer’s product is named and accompanied by “No Substitute,” including make or model number or other designation, provide product specified. (Note: Certain products have been selected for their unique characteristics and particular project suitability.)

    a. Where no additional products or manufacturers are listed in product category, requirements for “No Substitute” govern product selection.

2. Where products indicate “acceptable manufacturers” or “acceptable manufacturers and products”, provide product from specified manufacturers, subject to compliance with specified requirements and “Single Source Responsibility” requirements stated herein.

B. Supplier Qualifications and Responsibilities: Recognized architectural hardware supplier with record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that provides certified Architectural Hardware Consultant (AHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.

1. Warehousing Facilities: In Project's vicinity.
2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
4. Coordination Responsibility: Coordinate installation of electronic security hardware with Architect and electrical engineers and provide installation and technical data to Architect and other related subcontractors.

    a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

C. Installer Qualifications: Qualified tradesmen, skilled in application of commercial grade hardware with record of successful in-service performance for installing door hardware similar in quantity, type, and quality to that indicated for this Project.

D. Architectural Hardware Consultant Qualifications: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:

1. For door hardware, DHI-certified, Architectural Hardware Consultant (AHC).
2. Can provide installation and technical data to Architect and other related subcontractors.
3. Can inspect and verify components are in working order upon completion of installation.
4. Capable of producing wiring diagrams.
5. Capable of coordinating installation of electrified hardware with Architect and electrical engineers.

E. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated.
2. Manufacturers that perform electrical modifications and that are listed by testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

F. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.

G. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.

H. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

I. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.

J. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in "REFERENCES" article, herein.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
2. Maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
4. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.

K. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01.

1. Attendees: Owner, Contractor, Architect, Installer, and Supplier's Architectural Hardware Consultant.
2. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:

a. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
b. Preliminary key system schematic diagram.
c. Requirements for key control system.
d. Requirements for access control.
e. Address for delivery of keys.

L. Pre-installation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

M. Coordination Conferences:

1. Installation Coordination Conference: Prior to hardware installation, schedule and hold meeting to review questions or concerns related to proper installation and adjustment of door hardware.

a. Attendees: Door hardware supplier, door hardware installer, Contractor.
b. After meeting, provide letter of compliance to Architect, indicating when meeting was held and who was in attendance.

2. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

    a. Attendees: electrified door hardware supplier, doors and frames supplier, electrified door hardware installer, electrical subcontractor, Owner.
    b. After meeting, provide letter of compliance to Architect, indicating when coordination conference was held and who was in attendance.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

1. Deliver each article of hardware in manufacturer’s original packaging.

C. Project Conditions:

1. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
2. Provide secure lock-up for door hardware delivered to Project, but not yet installed. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.

D. Protection and Damage:

1. Promptly replace products damaged during shipping.
2. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.
3. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

E. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

F. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

F. Direct shipments not permitted, unless approved by Contractor.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Years from date of Substantial Completion, for durations indicated.

a. Closers:
1) Mechanical: 10 years.

b. Automatic Operators: 1 year.
c. Exit Devices:
1) Mechanical: 3 years.
2) Electrified: 1 year.

d. Locksets:
1) Mechanical: 3 years.
2) Electrified: 1 year.

e. Continuous Hinges: Lifetime warranty
f. Key Blanks: Lifetime

2. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.

1.09 MAINTENANCE

A. Extra Materials:

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents as required by Owner.

B. Maintenance Tools:

1. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.

1.10 REGULATORY REQUIREMENTS

A. Locate latching hardware between 34 inches to 44 inches above the finished floor, per 2016 California Building Code, Section 11b-404.2.7.

1. Panic Hardware: locate between 36 inches to 44 inches above the finished floor.

B. Handles, pull, latches, locks, other operating devices:

1. Readily openable from egress side without tight grasping, tight pinching, or twisting of the wrist to operate. 2016 California Building Code Section 11B-309.4.
2. Force required to activate the operable parts: 5.0 pounds maximum, per 2016 California Building Code Section 11b-309.4.

C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors. As allowed per 2016 California Building Code Section 11B-404.4.9, local authority may increase the allowable pressure for fire doors to achieve positive latching, but not to exceed 15-pounds.

1. [Exception: exterior doors' pressure-to-open may be increased to 8.5-pounds if: at a single location, and one of a bank of eight leafs or fraction of eight, and one leaf of this bank is fitted with a low- or high-energy operator.]

D. Low-energy powered doors: comply with ANSI/BHMA A156.19. Reference: 2016 California Building Code Section 11B-404.2.9, Exception 2.

1. Where powered door serves an occupancy of 150 or more, provide back-up battery power or stand-by generator power, capable of supporting a minimum of 150 cycles.
2. Actuators, vertical bar type: minimum 2-inches wide, 30-inches high, bottom located minimum 5-inches above floor or ground, top located minimum 35-inches above floor or ground. Displays International Symbol of Accessibility, per 2016 California Building Code Section 11B-703.7.
3. Actuators, plate type: use two at each side of the opening. Minimum 4-inches diameter or 4-inches square. Displays International Symbol of Accessibility, per 2016 California Building Code Section 11B-703.7. Locate centerline of lower plate between 7- and 8-inches above floor or ground, and upper plate between 30- and 44-inches above floor or ground.
4. Actuator location: conspicuously located, clear and level floor/ground space for forward or parallel approach.

E. Adjust door closer sweep periods so that from an open position of 90 degrees, the door will take at least 5 seconds to move to a point 12 degrees from the latch, measured to the landing side of the door, per 2016 California Building Code Section 11B-404.2.7.

1. Spring hinges: adjust for 1.5 seconds minimum for 70 degrees to fully-closed.

F. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per 2016 California Building Code Section 11B-404.2.10.

G. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees. Hardware projection not a factor in clear width if located above 30 inches and below 80 inches, and the hardware projects no more than 4 inches. 2016 California Building Code Section 11b-404.2.3.

1. Exception: doors not requiring full passage through the opening, that is, to spaces less than 24 inches in depth, may have the clear opening width reduced to 20 inches. Example: shallow closets.
2. Door closers and overhead stops: not less than 78 inches above the finished floor or ground, per 2016 California Building Code 11B-307.4.

H. Thresholds: floor or landing no more than 0.50 inches below the top of the threshold of the doorway per 2016 California Building Code Section 11B-404.2.5. Vertical rise no more than 0.25 inches, change in level between 0.25 inches and 0.50 inches: beveled to slope no greater than 1:2 (50 percent slope). 2016 California Building Code Section 11B-303.2-3.

I. Floor stops: Do not locate in path of travel. Locate no more than 4 inches from walls, per DSA Policy #99-08 (Access).

J. Pairs of doors: limit swing of inactive leaf to 90 degrees to protect persons reading wall-mounted tactile signage. [Pairs of doors with independently-activated hardware both leafs: limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per 2016 California Building Code Section 11B-703.4.2.]

K. Door and door hardware encroachment: when door is swung fully-open into means-of-egress path, the door, including the hardware, may not encroach/project more than 7 inches into the required exit width. 2010 California Building Code 1005.2 and 1005.3. [2016 California Building Code, Section 1005.7.1.

1. In I-2 occupancies, latch release hardware is not permitted to project in the required exit width, regardless of its mounting height.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Approval of products from manufacturers indicated in “Acceptable Manufacturers” is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer’s product.

B. 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.

C. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

A. Fasteners

1. Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.
2. Furnish screws for installation with each hardware item. Finish exposed (exposed under any condition) screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
3. Provide concealed fasteners for hardware units exposed when door is closed except when no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless thru-bolts are required to fasten hardware securely. Review door specification and advise Architect if thru-bolts are required.
4. Install hardware with fasteners provided by hardware manufacturer.

B. Modification and Preparation of Existing Doors: Where existing door hardware is indicated to be removed and reinstalled.

1. Provide necessary fillers, Dutchmen, reinforcements, and fasteners, compatible with existing materials, as required for mounting new opening hardware and to cover existing door and frame preparations.
2. Use materials which match materials of adjacent modified areas.
3. When modifying existing fire-rated openings, provide materials permitted by NFPA 80 as required to maintain fire-rating.

C. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.

1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Ives 5BB series
2. Acceptable Manufacturers and Products: Hager BB series, McKinney TA/T4A series, Stanley FBB Series

B. Requirements:

1. Provide five-knuckle ball bearing hinges conforming to ANSI/BHMA A156.1.
2. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:

a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high
b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high

3. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:

a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

4. 2 inches or thicker doors:

a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
b. Interior: Heavy weight, steel, 5 inches (127 mm) high

5. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
6. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
7. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:

a. Steel Hinges: Steel pins
b. Non-Ferrous Hinges: Stainless steel pins
c. Out-Swinging Exterior Doors: Non-removable pins
d. Out-Swinging Interior Lockable Doors: Non-removable pins
e. Interior Non-lockable Doors: Non-rising pins

8. Width of hinges: 4-1/2 inches (114 mm) at 1-3/4 inch (44 mm) thick doors, and 5 inches (127 mm) at 2 inches (51 mm) or thicker doors. Adjust hinge width as required for door, frame, and wall conditions to allow proper degree of opening.
9. Doors 36 inches (914 mm) wide or less furnish hinges 4-1/2 inches (114 mm) high; doors greater than 36 inches (914 mm) wide furnish hinges 5 inches (127 mm) high, heavy weight or standard weight as specified.
10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component.
11. Provide mortar guard for each electrified hinge specified.

2.04 CONTINUOUS HINGES

A. Aluminum Geared

1. Manufacturers:

a. Scheduled Manufacturer: Ives.
b. Acceptable Manufacturers: Select, Stanley.

2. Requirements:

a. Provide aluminum geared continuous hinges conforming to ANSI/BHMA A156.26, Grade 1.
b. Provide aluminum geared continuous hinges, where specified in the hardware sets, fabricated from 6063-T6 aluminum, with 0.25-inch (6 mm) diameter Teflon coated stainless steel hinge pin.
c. Provide split nylon bearings at each hinge knuckle for quiet, smooth, self-lubricating operation.
d. Provide hinges capable of supporting door weights up to 450 pounds, and successfully tested for 1,500,000 cycles.
e. On fire-rated doors, provide aluminum geared continuous hinges that are classified for use on rated doors by testing agency acceptable to authority having jurisdiction.
f. Provide aluminum geared continuous hinges with electrified option scheduled in the hardware sets. Provide with sufficient number and wire gage to accommodate electric function of specified hardware.
g. Install hinges with fasteners supplied by manufacturer.
h. Provide hinges 1 inch (25 mm) shorter in length than nominal height of door, unless otherwise noted or door details require shorter length and with symmetrical hole pattern.

2.05 ELECTRIC POWER TRANSFER

A. Manufacturers:

a. Scheduled Manufacturer: Von Duprin EPT-10
b. Acceptable Manufacturers: ABH PT1000, Securitron CEPT-10

B. Provide power transfer with electrified options as scheduled in the hardware sets. Provide with number and gage of wires sufficient to accommodate electric function of specified hardware.

C. Locate electric power transfer per manufacturer's template and UL requirements, unless interference with operation of door or other hardware items.

2.06 FLUSH BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.

2.07 SURFACE BOLTS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Surface bolt s to have 1" throw for maximum security with concealed mounting that prevents vandalism. Units to be constructed of heavy duty steel and cUL listed up to three (3) hours when used on the inactive door of a pair up to 8' in height.

2.08 COORDINATORS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.
2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices if required.

2.09 MORTISE LOCKS

A. Manufacturers and Products:

1. Owner Preferred Manufacturer and Product: Schlage L9000 series
2. Acceptable Manufacturers and Products: Corbin-Russwin ML2000 series, Best 45H series, Sargent 8200 series

B. Requirements:

1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
2. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
3. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
4. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide a request to exit (RX) switch that is actuated with rotation of inside lever.
5. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

    a. Lever Design: Schlage 03A.
    b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

2.10 EXIT DEVICES

A. Manufacturers and Products:

1. **Owner Preferred Manufacturer and Product: Von Duprin 98/35 series**
2. Acceptable Manufacturers and Products: Sargent 19-43-GL-80 series, Precision Apex series

B. Requirements:

1. Provide exit devices tested to ANSI/BHMA A156.3 Grade 1, and UL listed for Panic Exit or Fire Exit Hardware. Cylinders: Refer to "KEYING" article, herein.
2. Provide touchpad type exit devices, fabricated of brass, bronze, stainless steel, or aluminum, plated to standard architectural finishes to match balance of door hardware.
3. Touchpad: Extend minimum of one half of door width. Match exit device finish, stainless steel for US26, US26D, US28, US32, and US32D finishes; and for all other finishes, provide compatible finish to exit device. No plastic inserts are allowed in touchpads.
4. Provide exit devices with deadlatching feature for security and for future addition of alarm kits and/or other electrified requirements.
5. Provide flush end caps for exit devices.
6. Provide exit devices with manufacturer's approved strikes.
7. Provide exit devices cut to door width and height. Install exit devices at height recommended by exit device manufacturer, allowable by governing building codes, and approved by Architect.
8. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits.
9. Provide cylinder dogging at non-fire-rated exit devices.

10. Removable Mullions: 2 inches (51 mm) x 3 inches (76 mm) steel tube. Where scheduled as keyed removable mullion, provide type that can be removed by use of a keyed cylinder, which is self-locking when re-installed.
11. Where lever handles are specified as outside trim for exit devices, provide heavy-duty lever trims with forged or cast escutcheon plates. Provide vandal-resistant levers that will travel to 90-degree down position when more than 35 pounds of torque are applied, and which can easily be re-set.

    a. Lever Style: Match lever style of locksets.
    b. Tactile Warning (Knurling): Where required by authority having jurisdiction. Provide on levers on exterior (secure side) of doors serving rooms considered to be hazardous.

12. Provide UL labeled fire exit hardware for fire rated openings.
13. Provide factory drilled weep holes for exit devices used in full exterior application, highly corrosive areas, and where noted in hardware sets.
14. Provide electrified options as scheduled.
15. Provide devices with all control inputs – door position input, external inhibit input, fire alarm input; auxiliary locking; nuisance alarm and internal horn; and, remote signaling output self-contained in the device assembly.

2.11 POWER SUPPLIES

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: Schlage or Von Duprin PS900 series
2. Acceptable Manufacturers and Products: Precision ELR series, Sargent 3500 series, Dynalock 5000 series, Securitron BPS series, Security Door Controls 600 series

B. Requirements:

1. Provide power supplies, recommended and approved by manufacturer of electrified locking component, for operation of electrified locks, electrified exit devices, magnetic locks, electric strikes, and other components requiring power supply.
2. Provide appropriate quantity of power supplies necessary for proper operation of electrified locking components as recommended by manufacturer of electrified locking components with consideration for each electrified component using power supply, location of power supply, and approved wiring diagrams. Locate power supplies as directed by Architect.
3. Provide regulated and filtered 24 VDC power supply, and UL class 2 listed.
4. Options:

    a. Provide power supply, where specified, with internal capability of charging sealed backup batteries 24 VDC, in addition to operating DC load.
    b. Provide sealed batteries for battery back-up at each power supply where specified.
    c. Provide keyed power supply cabinet.

5. Provide power supply in an enclosure, complete, and requiring 120VAC to fused input.
6. Provide power supply with emergency release terminals, where specified, that allow release of all devices upon activation of fire alarm system complete with fire alarm input for initiating “no delay” exiting mode.

2.12 CYLINDERS

A. Manufacturers:

1. Owner Preferred Manufacturer: Schlage

B. Requirements:

1. Provide full size interchangeable cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.
2. Replaceable Construction Cores.

   a. Provide temporary construction cores replaceable by permanent cores, furnished in accordance with the following requirements.
      1) 3 construction control keys
      2) 12 construction change (day) keys.

   b. Owner or Owner's Representative will replace temporary construction cores with permanent cores.

2.13 KEYING

A. Provide a factory registered keying system, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Provide cylinders/cores keyed into Owner's existing keying system managed by Owner's locksmith, complying with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference. Contact:

1. Firm Name:
2. Contact Person:
3. Telephone:

C. Requirements:

1. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.

   a. Master Keying system as directed by the Owner, Schlage Everest D.

2. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements shall be cause for replacement of cylinders/cores involved at no additional cost to Owner.
3. Provide keys with the following features:

   a. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
   b. Patent Protection: Keys and blanks protected by one or more utility patent(s).

4. Identification:

   a. Mark permanent cylinders/cores and keys with applicable blind code per DHI publication "Keying Systems and Nomenclature" for identification. Blind code marks shall not include actual key cuts.

b. Identification stamping provisions must be approved by the Architect and Owner.
c. Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
d. Failure to comply with stamping requirements shall be cause for replacement of keys involved at no additional cost to Owner.
e. Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.

5. Quantity: Furnish in the following quantities.

a. Change (Day) Keys: 3 per cylinder/core.
b. Permanent Control Keys: 3.
c. Master Keys: 6.

2.14 DOOR CLOSERS

A. Manufacturers and Products:

1. Owner Preferred Manufacturer and Product: LCN 4010/4110 series
2. Acceptable Manufacturers and Products: Sargent 281/281P10 series factory assembled (without PRV)

B. Requirements:

1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. Stamp units with date of manufacture code.
2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
3. Cylinder Body: 1-1/2 inch (38 mm) diameter, with 5/8 inch (16 mm) diameter double heat-treated pinion journal.
4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
6. Hydraulic Regulation: By tamper-proof, non-critical valves with separate adjustment for latch speed, general speed, and backcheck.
7. Provide closers with a solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
8. Pressure Relief Valve (PRV) Technology: Not permitted.
9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI/BHMA Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.15 ELECTRO-HYDRAULIC AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN 4600 series

2. Acceptable Manufacturers and Products: Norton 6000 series, Besam Power Swing

B. Requirements:

1. Provide low energy automatic operator units with hydraulic closer complying with ANSI/BHMA A156.19.
2. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
3. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check, and opening and closing speed adjustment valves to control door
4. Provide units with on/off switch for manual operation, motor start up delay, vestibule interface delay, electric lock delay, and door hold open delay.
5. Provide units with conventional door closer opening and closing forces unless power operator motor is activated. Provide door closer assembly with adjustable spring size, back-check valve, sweep valve, latch valve to control door.
6. Provide drop plates, brackets, or adapters for arms as required for details.
7. Provide hard-wired actuator switches for operation as specified.
8. Provide weather-resistant actuators at exterior applications.
9. Provide key switches with LED's, recommended and approved by manufacturer of automatic operator as required for function described in operation description of hardware group below. Cylinders: Refer to "KEYING" article, herein.
10. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
11. Provide units with vestibule inputs that allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.16 ELECTRO-MECHANICAL AUTOMATIC OPERATORS

A. Manufacturers and Products:

1. Scheduled Manufacturer and Product: LCN Senior Swing
2. Acceptable Manufacturers and Products: Besam Swingmaster MP, Horton 4000LE series

B. Requirements:

1. Provide low energy automatic operator units that are electro-mechanical design complying with ANSI/BHMA A156.19.

   a. Opening: Powered by DC motor working through reduction gears.
   b. Closing: Spring force.
   c. Manual, hydraulic, or chain drive closers: Not permitted.
   d. Operation: Motor is off when door is in closing mode. Door can be manually operated with power on or off without damage to operator. Provide variable adjustments, including opening and closing speed adjustment.
   e. Cover: Aluminum.

2. Provide units with manual off/auto/hold-open switch, push and go function to activate power operator, vestibule interface delay, electric lock delay, hold-open delay adjustable from 2 to 30 seconds, and logic terminal to interface with accessories, mats, and sensors.

3. Provide drop plates, brackets, or adapters for arms as required to suit details.
4. Provide hard-wired motion sensors and/or actuator switches for operation as specified. Provide weather-resistant actuators at exterior applications.
5. Provide key switches, with LED's, recommended and approved by manufacturer of automatic operator as required for function as described in operation description of hardware sets. Cylinders: Refer to "KEYING" article, herein.
6. Provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by manufacturer of automatic operator for each individual leaf. Actuators control both doors simultaneously at pairs. Sequence operation of exterior and vestibule doors with automatic operators to allow ingress or egress through both sets of openings as directed by Architect. Locate actuators, key switches, and other controls as directed by Architect.
7. Provide units with inputs for smoke evacuation doors, where specified, which allow doors to power open upon fire alarm activation and hold open indefinitely or until fire alarm is reset, presence detector input, which prevents closed door from opening or door that is fully opened from closing, hold open toggle input, which allows remote activation for indefinite hold open and close second time input is activated, vestibule inputs, which allow sequencing operation of two units, and SPDT relay for interfacing with latching or locking devices.

2.17 DOOR TRIM

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide push plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick and beveled 4 edges. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
2. Provide push bars of solid bar stock, diameter and length as scheduled. Provide push bars of sufficient length to span from center to center of each stile. Where required, mount back to back with pull.
3. Provide offset pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
4. Provide flush pulls as scheduled. Where required, provide back-to-back mounted model.
5. Provide pulls of solid bar stock, diameter and length as scheduled. Where required, mount back to back with push bar.
6. Provide pull plates 4 inches (102 mm) wide by 16 inches (406 mm) high by 0.050 inch (1 mm) thick, beveled 4 edges, and prepped for pull. Where width of door stile prevents use of 4 inches (102 mm) wide plate, adjust width to fit.
7. Provide wire pulls of solid bar stock, diameter and length as scheduled.
8. Provide decorative pulls as scheduled. Where required, mount back to back with pull.

2.18 PROTECTION PLATES

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide kick plates, mop plates, and armor plates minimum of 0.050 inch (1 mm) thick, beveled four edges as scheduled. Furnish with sheet metal or wood screws, finished to match plates.
2. Sizes of plates:

a. Kick Plates: 10 inches (254 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
b. Mop Plates: 4 inches (102 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs
c. Armor Plates: 36 inches (914 mm) high by 2 inches (51 mm) less width of door on single doors, 1 inch (25 mm) less width of door on pairs

2.19 OVERHEAD STOPS AND OVERHEAD STOP/HOLDERS

A. Manufacturers:

1. Scheduled Manufacturers: Glynn-Johnson
2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

1. Provide heavy duty concealed mounted overhead stop or holder as specified for exterior and interior vestibule single acting doors.
2. Provide heavy duty concealed mounted overhead stop or holder as specified for double acting doors.
3. Provide heavy or medium duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide medium duty surface mounted overhead stop for interior doors and at any door that swings more than 140 degrees before striking wall, open against equipment, casework, sidelights, and where conditions do not allow wall stop or floor stop presents tripping hazard.
4. Where overhead holders are specified provide friction type at doors without closer and positive type at doors with closer.

2.20 DOOR STOPS AND HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Provide door stops at each door leaf:

1. Provide wall stops wherever possible. Provide convex type where mortise type locks are used and concave type where cylindrical type locks are used.
2. Where a wall stop cannot be used, provide universal floor stops for low or high rise options.
3. Where wall or floor stop cannot be used, provide medium duty surface mounted overhead stop.

2.21 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

A. Manufacturers:

1. Scheduled Manufacturer: Zero International
2. Acceptable Manufacturers: National Guard, Reese

B. Requirements:

1. Provide thresholds, weather-stripping (including door sweeps, seals, and astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.
2. Size of thresholds:

    a. Saddle Thresholds: 1/2 inch (13 mm) high by jamb width by door width
    b. Bumper Seal Thresholds: 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width

3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.

2.22 SILENCERS

A. Manufacturers:

1. Scheduled Manufacturer: Ives
2. Acceptable Manufacturers: Burns, Rockwood

B. Requirements:

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

2.23 MAGNETIC HOLDERS

A. Manufacturers:

1. Scheduled Manufacturer: LCN
2. Acceptable Manufacturers: Rixson, Sargent

B. Requirements:

1. Provide wall or floor mounted electromagnetic door release as specified with minimum of 25 pounds of holding force. Coordinate projection of holder and armature with other hardware and wall conditions to ensure that door sits parallel to wall when fully open. Connect magnetic holders on fire-rated doors into the fire control panel for fail-safe operation.

2.24 DOOR POSITION SWITCHES

A. Manufacturers:

1. Scheduled Manufacturer: Schlage
2. Acceptable Manufacturers: GE-Interlogix, Sargent

B. Requirements:

1. Provide recessed or surface mounted type door position switches as specified.
2. Coordinate door and frame preparations with door and frame suppliers. If switches are being used with magnetic locking device, provide minimum of 4 inches (102 mm) between switch and magnetic locking device.

2.25 COAT HOOKS

A. Manufacturers:

1. Scheduled Manufacturer: Ives.
2. Acceptable Manufacturers: Burns, Rockwood

B. Provide coat hooks as specified.

2.26 FINISHES

A. Finish: BHMA 626/652 (US26D); except:

1. Hinges at Exterior Doors: BHMA 630 (US32D)
2. Continuous Hinges: BHMA 628 (US28)
3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
4. Protection Plates: BHMA 630 (US32D)
5. Overhead Stops and Holders: BHMA 630 (US32D)
6. Door Closers: Powder Coat to Match
7. Wall Stops: BHMA 630 (US32D)
8. Weatherstripping: Clear Anodized Aluminum
9. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Where on-site modification of doors and frames is required:

1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
2. Field modify and prepare existing door and frame for new hardware being installed.
3. When modifications are exposed to view, use concealed fasteners, when possible.
4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:

   a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
   b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
   c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
2. Custom Steel Doors and Frames: HMMA 831.
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each hardware item in compliance with manufacturer’s instructions and recommendations, using only fasteners provided by manufacturer.

C. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.

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

E. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

F. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.

G. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

H. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as indicated in keying section.
2. Furnish permanent cores to Owner for installation.

I. Wiring: Coordinate with Division 26, ELECTRICAL sections for:

1. Conduit, junction boxes and wire pulls.
2. Connections to and from power supplies to electrified hardware.
3. Connections to fire/smoke alarm system and smoke evacuation system.
4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
5. Testing and labeling wires with Architect's opening number.

J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers shall not be visible in corridors, lobbies and other public spaces unless approved by Architect.

L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.

M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.

1. Configuration: Provide least number of power supplies required to adequately serve doors with electrified door hardware.

N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.

P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

R. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Engage qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.05 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.06 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.07 DEMONSTRATION

A. Provide training for Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.08 DOOR HARDWARE SCHEDULE

A. Locksets, exit devices, and other hardware items are referenced in the following hardware sets for series, type and function. Refer to the above-specifications for special features, options, cylinders/keying, and other requirements.

B. Hardware Sets:

HARDWARE GROUP NO. 01

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC PANIC HARDWARE	SD-RX-LC-QEL-98-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX KEY SWITCH CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 DOGGING CYLINDER	626	SCH
3	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" STD	630-316	IVE
1	EA	OH STOP	100S	630	GLY
1	EA	SURF. AUTO OPERATOR	9542 MS	ANCLR	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	CREDENTIAL READER	SUPPLIED BY ACCESS CONTROL PROVIDER		
1	EA	KEY SWITCH	653-04	630	SCE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-4RL	LGR	SCE
1	EA	DIAGRAM	ELEVATION		DLR
1	EA	DIAGRAM	POINT TO POINT		DLR

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

OPERATIONAL DESCRIPTION:
COORDINATE WITH ALL RELATED TRADES. ENTRY BY CREDENTIAL OR KEY OVERRIDE. PRESENTING VALID CREDENTIAL TO READER WILL RETRACT LATCHBOLT ON PANIC HARDWARE AND ALLOW ENTRY.
KEY SWITCH AVAILABLE TO ACTIVATE EXTERIOR ACTUATOR FOR USE AUTOMATIC OPERATOR EXTERIOR ACTUATOR ACTIVE WHEN DOOR IS UNLOCKED FOR SET TIME. INTERIOR ACTUATOR ALWAYS ACTIVE.
UPON LOSS OF POWER DOOR IS LOCKED. DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.
DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 02

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	CDSI-98-EO	626	VON
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 DOGGING CYLINDER	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" STD	630-316	IVE
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 03

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	CDSI-98-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 DOGGING CYLINDER	626	SCH
2	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" STD	630-316	IVE
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN

HARDWARE GROUP NO. 04

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD	628	IVE
1	EA	PANIC HARDWARE	CDSI-98-EO	626	VON

1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 DOGGING CYLINDER	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	90 DEG OFFSET PULL	8190EZHD 10" STD	630-316	IVE
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN

HARDWARE GROUP NO. 05

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-JD	626	SCE
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	DESK MOUNT BUTTON	660-PB	628	SCE
1	EA	POWER SUPPLY	PS902 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.
ENTRY BY CREDENTIAL OR KEY OVERRIDE.
PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK LOCK AND ALLOW ENTRY.
PUSHBUTTON AT RECEPTION WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.
DOOR CONTACTS TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 06

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-JD	626	SCE
1	EA	SGL CYL DEADBOLT	B660T	626	SCH
2	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	DESK MOUNT BUTTON	660-PB	628	SCE
1	EA	POWER SUPPLY	PS902 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.
ENTRY BY CREDENTIAL OR KEY OVERRIDE.
PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK LOCK AND ALLOW ENTRY FROM RECEPTION TO CORRIDOR.
PUSHBUTTON AT RECEPTION WILL MOMENTARILY UNLOCK LOCK AND ALLOW ENTRY FROM RECEPTION TO CORRIDOR.
DEADBOLT CYLINDER TO LOCK FROM CORRIDOR TO RECEPTION.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.
DOOR CONTACTS TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 07

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	MORTISE CYL TURN	09-900 118 XB11-720	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 08

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	DUMMY TRIM	AD-993DT-RHO-JD	626	SCE
2	EA	ELEC PANIC HARDWARE	LD-RX-LC-98-EO	626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993M-70-MT-RHO-JD	626	SCE
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
2	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	429AA-S	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
2	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 09

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
2	EA	PANIC HARDWARE	98-L-2SI-06	626	VON
2	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
3	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	RIM CYL THUMBTURN	XB11-979 INTERIOR CYLINDER	626	SCH
2	EA	SURFACE CLOSER	4111 CUSH	689	LCN

WEATHERSTRIPPING BY ALUMINUM DOOR SUPPLIER.

HARDWARE GROUP NO. 10

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	CDSI-98-EO	626	VON
1	EA	PANIC HARDWARE	CDSI-98-NL-OP-110MD	626	VON
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
2	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10" STD	630-316	IVE
2	EA	SURFACE CLOSER	4111 CUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA-S	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
2	EA	MULLION SEAL	8780NBK PSA	BK	ZER

2	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 11

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	DUMMY TRIM	AD-993DT-RHO-JD FOR INACTIVE LEAF	626	SCE
2	EA	ELEC PANIC HARDWARE	CDSI-RX-LC-98-EO	626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993M-70-MT-RHO-JD FOR ACTIVE LEAF	626	SCE
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 DOGGING CYLINDER	626	SCH
3	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	SURFACE CLOSER	4111 CUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	ASTRAGAL	BY DOOR/FRAME MANUFACTURER		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
2	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

OPERATIONAL DESCRIPTION:
COORDINATE WITH ALL RELATED TRADES.

ENTRY BY CREDENTIAL OR KEY OVERRIDE. CYLINDER DOGGING AVAILABLE.
PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK PANIC HARDWARE AND ALLOW ENTRY.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.
DOOR CONTACTS TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 12

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	L9040 06A	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	COAT AND HAT HOOK	572	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 13

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	MORTISE CYL TURN	09-900 118 XB11-720	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 14

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	DOOR BOTTOM	369AA	AA	ZER
1	EA	THRESHOLD	63A	A	ZER
1	EA	GASKETING	188S PSA	BK	ZER

HARDWARE GROUP NO. 15

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	MORTISE CYL TURN	09-900 118 XB11-720	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 16

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	MORTISE CYL TURN	09-900 118 XB11-720	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	OH STOP	90S	630	GLY
1	EA	DOOR BOTTOM	369AA	AA	ZER
1	EA	THRESHOLD	63A	A	ZER
1	EA	GASKETING	188S PSA	BK	ZER

HARDWARE GROUP NO. 17

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	MORTISE CYL TURN	09-900 118 XB11-720	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE

HARDWARE GROUP NO. 18

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE

1	EA	OFFICE/ENTRY LOCK	L9050T 06A L583-363	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	COAT AND HAT HOOK	572	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 19

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	OH STOP	90S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 20

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	98-L-BE-F-06	626	VON
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	188S PSA	BK	ZER

HARDWARE GROUP NO. 21

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	MORTISE CYL TURN	09-900 118 XB11-720	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 22

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 23

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	OH STOP	450S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 24

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	OH STOP	450S	630	GLY
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 25

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-98-EO	626	VON
1	EA	ELEC PANIC HARDWARE	RX-LC-QEL-98-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
2	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10" STD	630-316	IVE
1	EA	OH STOP	100S	630	GLY

1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	SURF. AUTO OPERATOR	9542 MS	ANCLR	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
1	EA	GASKETING	429AA-S	AA	ZER
2	EA	MEETING STILE	8879AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
2	EA	MULLION SEAL	8780NBK PSA	BK	ZER
1	EA	CREDENTIAL READER	SUPPLIED BY ACCESS CONTROL PROVIDER		
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 900-2RS COORDINATE POWER SUPPLY REQUIREMENT WITH SECURITY PROVIDER	LGR	SCE
1	EA	DIAGRAM	ELEVATION		DLR
1	EA	DIAGRAM	POINT TO POINT		DLR

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

OPERATIONAL DESCRIPTION:
COORDINATE WITH ALL RELATED TRADES. ENTRY BY CREDENTIAL OR KEY OVERRIDE. PRESENTING VALID CREDENTIAL TO READER WILL RETRACT LATCHBOLT ON PANIC HARDWARE AND ALLOW ENTRY.
AUTOMATIC OPERATOR EXTERIOR ACTUATOR ACTIVE WHEN DOOR IS UNLOCKED FOR SET TIME. INTERIOR ACTUATOR ALWAYS ACTIVE.
UPON LOSS OF POWER DOOR IS LOCKED. DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.
DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 26

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	OFFICE/ENTRY LOCK	L9050T 06A L583-363	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	COAT AND HAT HOOK	572	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 27

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	628	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	CDSI-98-EO	626	VON
1	EA	PANIC HARDWARE	CDSI-98-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 DOGGING CYLINDER	626	SCH
4	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	90 DEG OFFSET PULL	8190EZHD 10" STD	630-316	IVE
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	RAIN DRIP	142AA	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

DOOR CONTACTS TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 28

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 EDA INSTALL TO SWING 180 DEGREES.	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 29

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	DUMMY TRIM	AD-993DT-RHO-JD	626	SCE
1	EA	ELEC PANIC HARDWARE	LD-RX-LC-98-EO	626	VON
1	EA	ELEC EXIT DEVICE TRIM	AD-300-993M-70-MT-RHO-JD	626	SCE
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
2	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	ASTRAGAL	BY DOOR/FRAME MANUFACTURER		
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE
1	EA	POWER SUPPLY	PS902 COORDINATE POWER SUPPLY REQUIREMENT WITH SECURITY PROVIDER	LGR	SCE
1	EA	DIAGRAM	ELEVATION		DLR
1	EA	DIAGRAM	POINT TO POINT		DLR

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

OPERATIONAL DESCRIPTION:
COORDINATE WITH ALL RELATED TRADES.
ENTRY BY CREDENTIAL OR KEY OVERRIDE.
PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK PANIC HARDWARE TRIM AND ALLOW ENTRY.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.
DOOR CONTACTS TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 30

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP DOOR HARDWARE	652	IVE

1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH SRI	689	LCN

HARDWARE GROUP NO. 31

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	MORTISE CYL TURN	09-900 118 XB11-720	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	188S PSA	BK	ZER

HARDWARE GROUP NO. 32

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM SECURITY	L9071T 06A L283-711 LESS INSIDE CYLINDER - INSTALL THUMBTURN	626	SCH
1	EA	MORTISE CYL TURN	09-900 118 XB11-720	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	188S PSA	BK	ZER

HARDWARE GROUP NO. 33

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	L9010 06A	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 34

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	188S PSA	BK	ZER

HARDWARE GROUP NO. 35

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FAC RESTRM W/IND	L9486T 06A L583-363	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	188S PSA	BK	ZER
1	EA	COAT AND HAT HOOK	572	626	IVE

HARDWARE GROUP NO. 36

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954	689	VON
2	EA	FIRE EXIT HARDWARE	9847-L-F-LBR-06	626	VON
2	EA	RIM CYLINDER	20-057 ICX	626	SCH
1	EA	MORTISE CYLINDER	TRIM CYLINDER 20-061 ICX	626	SCH
3	EA	FSIC CORE	MULLION CYLINDER 23-030 EV D	626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	MEETING STILE	8195AA	AA	ZER
1	EA	GASKETING	188S PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER

HARDWARE GROUP NO. 37

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	ARMOR PLATE	8400 34" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	VIEWER	698	626	IVE
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 38

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	LD-98-EO	626	VON
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 39

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY LOCK	L9040 06A	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 40

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	98-L-2SI-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	RIM CYL THUMBTURN	XB11-979 INTERIOR CYLINDER	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 41

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
2	EA	PANIC HARDWARE	CDSI-98-EO	626	VON
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 DOGGING CYLINDER	626	SCH
3	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
	EA	GASKETING	429AA-S	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 42

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
8	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	LD-98-EO	626	VON
1	EA	PANIC HARDWARE	LD-98-NL-OP-110MD	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
2	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	SURFACE CLOSER	4111 HCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA-S	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 43

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE

1	EA	FAC RESTRM W/IND	L9486T 06A L583-363	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	GASKETING	188S PSA	BK	ZER
1	EA	COAT AND HAT HOOK	572	626	IVE

HARDWARE GROUP NO. 44

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	LD-98-L-2SI-06	626	VON
1	EA	PANIC HARDWARE	LD-98-L-BE-2SI-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	RIM CYL THUMBTURN	XB11-979 INTERIOR CYLINDER	626	SCH
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
1	EA	GASKETING	139A-S	A	ZER
1	EA	GASKETING	870AA-S	AA	ZER
2	EA	DOOR BOTTOM	369AA	AA	ZER
1	EA	THRESHOLD	63A	A	ZER
1	EA	GASKETING	188S PSA	BK	ZER
2	EA	MOUNTING BRACKET	870SPB		ZER

HARDWARE GROUP NO. 45

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
2	EA	PANIC HARDWARE	CDSI-9847-DT-LBR	626	VON
1	EA	ELEC PANIC HARDWARE	SD-RX-LC-QEL-9847-NL-LBR	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX KEY SWITCH CYLINDER	626	SCH
2	EA	MORTISE CYLINDER	20-061 ICX XQ11-948 DOGGING CYLINDER	626	SCH
4	EA	FSIC CORE	23-030 EV D	626	SCH

1	EA	OH STOP	100S	630	GLY
1	EA	SURFACE CLOSER	4111 CUSH	689	LCN
1	EA	SURF. AUTO OPERATOR	9542 MS	ANCLR	LCN
2	EA	ACTUATOR, WALL MOUNT	8310-853T	630	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	SILENCER	SR64	GRY	IVE
1	EA	KEY SWITCH	653-04	630	SCE
1	EA	POWER SUPPLY	PS902 900-2RS 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. ENTRY BY KEY.
DOOR NORMALLY DOGGED FOR PUSH/PULL FUNCTION. KEY SWITCH TO ACTIVATE EXTERIOR ACTUATOR FOR USE WHEN DOOR IS UNLOCKED.
AUTOMATIC OPERATOR ACTUATOR IN CORRIDOR 1800A TO BE ACTIVE WHEN DOOR IS UNLOCKED. INTERIOR ACTUATOR IN CORRIDOR 1800B ALWAYS ACTIVE.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.

HARDWARE GROUP NO. 46

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	FIRE EXIT HARDWARE	9847-L-BE-F-LBR-06	626	VON
2	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
2	EA	MEETING STILE	8879AA	AA	ZER
1	EA	GASKETING	188S PSA	BK	ZER

HARDWARE GROUP NO. 47

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	FIRE RATED REMOVABLE MULLION	KR9954	689	VON
2	EA	FIRE EXIT HARDWARE	98-L-F-2SI-06	626	VON
2	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
3	EA	FSIC CORE	23-030 EV D	626	SCH

2	EA	SURFACE CLOSER	4111 CUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	MEETING STILE	8879AA	AA	ZER
1	EA	GASKETING	188S PSA	BK	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER

HARDWARE GROUP NO. 48

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 49

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	L9070T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 50

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	MANUAL FLUSH BOLT	FB458 TOP BOLT ONLY	626	IVE
1	EA	CLASSROOM LOCK	L9070T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	OH STOP	450S	630	GLY
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 51

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 52

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	DOOR SWEEP	8192AA	AA	ZER
1	EA	THRESHOLD	655A	A	ZER

FREE EGRESS FROM ROOF TO STAIR.

HARDWARE GROUP NO. 53

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 54

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	MANUAL FLUSH BOLT	FB458	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	L9080T 06A	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH

1	EA	COORDINATOR	COR X FL	628	IVE
2	EA	MOUNTING BRACKET	MB	689	IVE
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142AA	AA	ZER
1	EA	GASKETING	429AA-S	AA	ZER
1	EA	ASTRAGAL	OVERLAPPING ASTRAGAL BY DOOR MANUFACTURER		
2	EA	DOOR SWEEP	8192AA	AA	ZER
1	EA	THRESHOLD	655A	A	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 55

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-JD	626	SCE
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	SUPPLIED BY ACCESS CONTROL PROVIDER		
1	EA	POWER SUPPLY	PS902 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.
ENTRY BY CREDENTIAL OR KEY OVERRIDE.
PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK LOCK AND ALLOW ENTRY.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.
DOOR CONTACTS TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 56

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	POWER TRANSFER	EPT10	689	VON
1	EA	ELEC CLASSROOM LOCK	AD-300-MS-70-MT-RHO-JD	626	SCE
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	SURFACE CLOSER	4011	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CVX	630	IVE
3	EA	SILENCER	SR64	GRY	IVE
1	EA	CREDENTIAL READER	SUPPLIED BY ACCESS CONTROL PROVIDER		
1	EA	POWER SUPPLY	PS902 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.
ENTRY BY CREDENTIAL OR KEY OVERRIDE.
PRESENTING VALID CREDENTIAL TO READER WILL UNLOCK LOCK AND ALLOW ENTRY.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS.
DOOR CONTACTS TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 57

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD	628	IVE
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	98-EO	626	VON
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	SET	GASKETING	BY DOOR/FRAME MANUFACTURER		
1	EA	ASTRAGAL	BY DOOR/FRAME MANUFACTURER		
1	EA	THRESHOLD	655A	A	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS,

BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING.

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 58

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1 5 X 4.5	652	IVE
2	EA	FIRE EXIT HARDWARE	9847-EO-F-LBR	626	VON
2	EA	SURFACE CLOSER	4011	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	FIRE/LIFE WALL MAG	SEM7850	689	LCN
1	EA	ASTRAGAL	BY DOOR/FRAME MANUFACTURER		
1	EA	GASKETING	188S PSA	BK	ZER

COORDINATE WITH ALL RELATED TRADES.
DOORS NORMALLY HELD OPEN.
UPON LOSS OF POWER OR FIRE ALARM, WALL MAGNETS TO RELEASE AND DOORS WILL CLOSE.
DOOR IS ALWAYS AVAILABLE FOR FREE EGRESS

HARDWARE GROUP NO. 59

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	CONT. HINGE	112HD EPT	628	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	REMOVABLE MULLION	KR4954	689	VON
1	EA	PANIC HARDWARE	98-EO	626	VON
1	EA	PANIC HARDWARE	98-NL	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	MORTISE CYLINDER	20-061 ICX MULLION CYLINDER	626	SCH
2	EA	FSIC CORE	23-030 EV D	626	SCH
2	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
1	EA	GASKETING	429AA-S	AA	ZER
2	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER
2	EA	MULLION SEAL	8780NBK PSA	BK	ZER
2	EA	DOOR CONTACT	679-05HM	BLK	SCE

WIND IMPACT:
THE HARDWARE SUPPLIER SHALL COORDINATE CYLINDER REQUIREMENTS WITH THE WIND IMPACT DOOR SUPPLIER'S HARDWARE & FURNISH THE TYPE REQUIRED.
THE HARDWARE SUPPLIER SHALL BE RESPONSIBLE TO INCLUDE ANY FASTENERS, BRACKETS, AND HARDWARE ACCESSORIES REQUIRED TO COMPLETE THE INTENDED APPLICATION.
THE WIND IMPACT DOOR SUPPLIER SHALL FURNISH THE HANGING HARDWARE, THE PANIC EXIT DEVICE HARDWARE, AND THE WEATHERSTRIPPING

DOOR CONTACT TIED TO ACCESS CONTROL SYSTEM FOR MONITORING.

HARDWARE GROUP NO. 60

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	SPRING HINGE	3SP1 4.5 X 4.5	652	IVE
4	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	9875-L-2-06	626	VON
1	EA	RIM CYLINDER	20-057 ICX TRIM CYLINDER	626	SCH
1	EA	FSIC CORE	23-030 EV D	626	SCH
1	EA	RIM CYL THUMBTURN	XB11-979 INTERIOR CYLINDER	626	SCH
1	EA	SURFACE CLOSER	4111 EDA	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	WALL STOP	WS406/407CVX	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 61

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8303 10" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4111 SCUSH	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

End of Section

Door/Hardware Index

Mark #	HWSet #
1001A	01
1001B	02
1001C	02
1001D	02
1001E	03
1001F	04
1001G	04
1001H	04
1002A	43
1100C	07
1101	18
1102A	06
1102B	05
1102C	55
1103A	56
1103B	33
1104	18
1105	22
1106	18
1107	49
1108	18
1110	49
1112	18
1114	18
1115	12
1116	18
1117	12
1118	18
1118B	12
1119	22
1120	18
1121	18
1122	53
1201A	47
1201B	47
1201C	10
1201D	10
1201E	41
1201F	41
1202	18
1203A	18

Mark #	HWSet #
1203B	49
1204A	18
1204B	18
1205	48
1206A	18
1206B	39
1207	18
1208A	18
1208B	39
1209A	18
1209B	18
1211	18
1212A	51
1212B	52
1213	48
1302A	36
1302B	27
1303	30
1308A	37
1308B	61
1308C	61
1309	18
1311	54
1312	19
1313A	12
1319	42
1400B	25
1402	17
1404	17
1406A	44
1406B	38
1408	18
1410	50
1412A	44
1412B	38
1413A	44
1413B	38
1415	50
1416	18
1417	19
1418	50

Mark #	HWSet #
1500A	58
1500B	11
1501A	09
1501B	29
1503A	31
1503B	31
1505	18
1507	49
1700	10
1702	13
1703	13
1704	13
1705A	40
1705B	60
1706	13
1707	28
1708	13
1709A	13
1709B	13
1710	13
1711A	60
1711B	40
1712A	20
1712B	08
1800A	45
1800B	08
1800C	10
1801A	57
1801B	57
1803	34
1804	35
1806	35
1807A	13
1807B	13
1808	32
1809A	14
1809B	16
1809C	13
1810	13
1811	15
1811A	18

Mark #	HWSet #
1812	13
1813A	24
1813B	24
1814	18
1815	15
1815A	18
1816	18
1818	23
1820	18
1822	18
1824	13
1826	13
1828A	20
1828B	59
2702	21
2703	13
2704	13
2705A	40
2705B	60
2706	13
2707	28
2708	13
2709A	13
2709B	13
2710	13
2711A	60
2711B	40
2712	46
2802A	35
2803	13
2804	35
2805	26
2806	28
2807	13
2808	32
2809	13
2810	13
2812A	40
2812B	60
2813	13
2814	28
2816A	13
2816B	13
2817	13
2818A	60
2818B	40
2819	13
2826	53
2828	46

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

D. Section 08 41 13 - Aluminum-Framed Entrances and Storefronts: Glazing furnished as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.

F. ASTM C1036 - Standard Specification for Flat Glass.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants.

I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.

J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.

K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.

L. GANA (GM) - GANA Glazing Manual.

M. GANA (SM) - GANA Sealant Manual.

N. GANA (LGRM) - Laminated Glazing Reference Manual.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.

P. NFRC 100 - Procedure for Determining Fenestration Product U-factors.

Q. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.

R. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.

1.04 SUBMITTALS

A. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Samples: Submit two samples 12 by 12 inch (305 by 305 mm) in size of glass units.

D. Samples: Submit 6 inch (152 mm) long bead of glazing sealant, color as selected.

E. Certificates: Certify that products meet or exceed performance specified.

F. 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.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Float Glass Manufacturers:
   1. AGC Glass Company North America, Inc: www.us.agc.com.
   2. Cardinal Glass Industries: www.cardinalcorp.com.
   3. Guardian Industries Corp: www.sunguardglass.com.
   4. Pilkington North America Inc: www.pilkington.com/na.
   5. PPG Industries, Inc: www.ppgideascapes.com. (Basis of Design)
   6. Substitutions: Refer to Section 01 60 00 - 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: Calculated in accordance with ASCE 7.
   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. 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 noted otherwise.
   1. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
   3. Safety Wired Glass Type: ASTM C1036, Type II - Wired Flat Glass, Quality-Q5, ANSI Z97.1 and 16 CFR 1201 impact criteria for Class B/Category I, and color and performance characteristics as indicated.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
   1. Any of the manufacturers specified for float glass.

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: Aluminum.
   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.
   6. Color: Grey.
   7. Purge interpane space with dry air, hermetically sealed.

C. Type G1 - Insulating Tinted Tempered Glass Units: Vision glass, double glazed.
   1. Applications: Exterior tempered glazing as scheduled or required.
   2. Space between lites filled with air.
   3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Gray.
      b. Coating: Low-E (passive type), on #2 surface.
   4. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
   5. Total Thickness: 1 inch (25.4 mm).

D. Type G2 - Insulating Glass Units: Spandrel glazing.
   1. Applications: Exterior spandrel glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
      b. Coating: Same as on vision units, on #2 surface.
   4. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
      a. Tint: Clear.
      b. Opacifier: Ceramic frit, on #4 surface.
      c. Opacifier Color: As scheduled.
   5. Total Thickness: 1 inch (25.4 mm).

E. Type G5 - Insulating Glass Units: Spandrel glazing.
   1. Applications: Exterior spandrel glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
      b. Coating: Same as on vision units, on #2 surface.

4. Inboard Lite: Fully tempered float glass, 1/4 inch (6.4 mm) thick.
    a. Tint: Clear.
    b. Opacifier: Ceramic frit, on #4 surface.
    c. Opacifier Color: As scheduled.
5. Total Thickness: 1 inch (25.4 mm).

2.05 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Insulating Glass Units: Vision glazing, with Low-E coating.
    1. Applications: Exterior insulating glass glazing unless otherwise indicated.
    2. Space between lites filled with air.
    3. Total Thickness: 1 inch (25.4 mm).
    4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.28, nominal.
    5. Visible Light Transmittance (VLT): 64 percent, nominal.
    6. Solar Heat Gain Coefficient (SHGC): 0.27, nominal.
    7. Visible Light Reflectance, Outside: 12 percent, nominal.
    8. Basis of Design - Vitro Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
    9. Outboard Lite: Fully Tempered as scheduled float glass, 1/4 inch (6.4 mm) thick, minimum.
        a. Low-E Coating: Vitro Glass (formerly PPG Glass) Solarban 70XL on #2 surface.
        b. Glass: Clear.
    10. Inboard Lite: Fully tempered as scheduled float glass, 1/4 inch (6.4 mm) thick.
        a. Coating: No coating on inboard lite.

2.06 GLAZING UNITS

A. Type G3 - Monolithic Interior Vision Glazing:
    1. Applications: Interior glazing unless otherwise indicated.
    2. Glass Type: Fully tempered float glass.
    3. Tint: Clear.
    4. Thickness: 1/4 inch (6.4 mm), nominal.

B. Type G4 - Safety Wired Glazing: Flat glass with embedded wire mesh.
    1. Applications: Locations as indicated on drawings.
    2. Form: Form 1 - Wired glass, polished both sides; ASTM C1036.
    3. Mesh: M2 - Square; ASTM C1036.
    4. Tint: Clear, Class 1.
    5. Glass Type: Annealed.
    6. Thickness: 1/4 inch (6.4 mm), nominal.

2.07 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; selected color.

2.08 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 (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.

B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.

C. Glazing Clips: Manufacturer's standard type.

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

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (610 mm) centers, kept 1/4 inch (6 mm) below sight line.

C. Locate and secure glazing pane using glazers' clips.

D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.05 INSTALLATION - WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

D. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.

F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/4 inch (6.4 mm) below sight lines.
   1. Place glazing tape on glazing pane of unit with tape flush with sight line.

G. Fill gap between glazing and stop with required type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.

H. Apply cap bead of required type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.06 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent 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.

END OF SECTION

SECTION 09 05 61

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section applies to all floors identified in the contract documents as to receive the following types of floor coverings:
   1. Resilient tile.
   2. Carpet tile.

B. Preparation of new concrete floor slabs for installation of floor coverings.

C. Testing of concrete floor slabs for moisture and alkalinity (pH).

D. Remedial floor coatings.

1.02 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens).

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.03 SUBMITTALS

A. 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.

B. 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. Product data for recommended remedial coating.
   7. Submit report to Architect.
   8. Submit report not more than two business days after conclusion of testing.

C. Adhesive Bond and Compatibility Test Report.

D. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.

1.04 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Construction Manager.

B. Construction Manager may perform adhesive and bond test with his own personnel or hire a testing agency.

C. 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.

D. Construction Manager'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.

E. 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.

1.05 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.

1.06 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 (18 degrees C) or more than 85 degrees F (30 degrees C).

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. 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.
   2. Use product recommended by testing agency.

PART 3 - EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Moisture vapor emission tests; 3 tests in the first 1000 square feet (100 square meters) and one test in each additional 1000 square feet (100 square meters), unless otherwise indicated or required by flooring manufacturer.

3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. 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 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

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 (1.4 kg per 93 square meters) 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 Construction Manager'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 (25 mm) 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 PREPARATION

A. See individual floor covering sections for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.06 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.07 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.08 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

SECTION 09 21 16.23

GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Gypsum board shaft wall assemblies.

1.02 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1.03 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: For shaft wall assemblies and firestop tracks, from ICC-ES.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

B. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice”.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not deliver or install gypsum board until building is enclosed and until construction in spaces are complete and ambient temperature and humidity conditions are maintained at the levels referenced in industry standard and manufacturer's written instructions.

C. Do not install interior products until installation areas are enclosed and conditioned.

D. Do not install panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

2.02 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated.

B. STC Rating: 51, minimum.

C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
   1. Depth: As indicated.
   2. Minimum Base-Metal Thickness: 22 gauge.

D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches (51 mm) long and matching studs in depth.
   1. Minimum Base-Metal Thickness: 22 gauge.

E. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.

F. Elevator Hoistway Entrances: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches (76 mm), matching studs in depth, and not less than 22 gauge thick.

G. Room-Side Finish: As indicated.

H. Shaft-Side Finish: As indicated.

I. Insulation: Sound attenuation blankets.

2.03 PANEL PRODUCTS

A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. CertainTeed Corp.; ProRoc Shaftliner.
      b. Georgia-Pacific Gypsum LLC, Subsidiary of Georgia Pacific; ToughRock Fireguard Shaftliner.
      c. Lafarge North America, Inc.; Firecheck Type X Shaftliner.
      d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
      e. USG Corporation; Sheetrock Brand Gypsum Liner Panel.
   2. Thickness: 1 inch (25.4 mm).
   3. Long Edges: Double bevel.

C. Gypsum Board: As specified in Section 09 29 00 "Gypsum Board."

2.04 NON-LOAD-BEARING STEEL FRAMING

A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   1. Protective Coating: ASTM A 653/A 653M and ASTM A1003/A1003M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

B. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. ClarkDietrich Building Systems; BlazeFrame DSL or MaxTrak Slotted Deflection Track.
      b. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
      c. Grace Construction Products; FlameSafe FlowTrak System.
      d. Metal-Lite, Inc.; The System.
      e. Steel Network Inc. (The); VertiClip SLD Series.

2.05 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.

C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
   1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
   2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.

E. Sound Attenuation Blankets: As specified in Section 07 21 00 Thermal Insulation."

F. Acoustical Sealant: As specified in Section 07 92 00 Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
   1. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 22 gauge minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

I. Cant Panels: At projections into shaft exceeding 4 inches (102 mm), install 1/2- or 5/8-inch- (13- or 16-mm-) thick gypsum board cants covering tops of projections.
   1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) o.c. with screws fastened to shaft wall framing.
   2. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) o.c. and extend studs from the projection to shaft wall framing.

J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.03 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
   2. Suspension systems for interior gypsum ceilings and soffits.

B. Related Requirements:
   1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior non-load-bearing wall studs.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

A. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.02 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 645; roll-formed from hot-dipped galvanized steel; complying with ASTM A 1003/A 1003M and ASTM A 653/A 653M G40 (Z120) or having a coating that provides equivalent corrosion resistance. A40 galvannealed products are not acceptable.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
   2. Protective Coating: ASTM A 653/A 653M, G60 (Z180), hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645. Use either steel studs and runners or equivalent gauge steel studs and runners.
   1. Equivalent Gauge Steel Studs and Runners:
      a. Minimum Base-Metal Thickness: 0.019 inch (20 gauge).
      b. Depth: As indicated on Drawings.
      c. Product: ClarkDietrich ProSTUD/ProTRAK 20.

C. Slip-Type Head Joints: Where indicated, provide one of the following:
   1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    a. Products: Subject to compliance with requirements, provide one of the following:
        1) ClarkDietrich Building Systems; MaxTrak or BlazeFrame DSL Slotted Deflection Track .
        2) MBA Building Supplies; Slotted Deflecto Track.
        3) Steel Network Inc. (The); VertiTrack VTD Series.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    1. Products: Subject to compliance with requirements, provide one of the following:
        a. ClarkDietrich Building Systems; MaxTrak or BlazeFrame DSL Slotted Deflection Track.
        b. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
        c. Grace Construction Products; FlameSafe FlowTrak.
        d. Metal-Lite, Inc.; The System.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
    1. Minimum Base-Metal Thickness: 22 gauge.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
    1. Depth: As indicated on Drawings.
    2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
    1. Minimum Base-Metal Thickness: 22 gauge.
    2. Depth: As indicated on Drawings.

H. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
    1. Configuration: Asymmetrical or hat shaped.
    2. Product: ClarkDietrich Building Systems; Resilient Channel RC Deluxe (RCSD), or a comparable product.

I. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
    1. Depth: 3/4 inch (19 mm) unless otherwise indicated.
    2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.0296 inch (.75 mm).
    3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

J. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
    1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Backing Plate or comparable product from one of the other specified manufacturers.
        a. Minimum Base-Steel Thickness: 0.0179 inch .

K. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

L. Radius Framing: Steel sheet runner for non-load-bearing curves, bends, variable radii and arches using a work-hardened steel base strip.
   1. Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Framing Contour Track (CNTB), or a comparable product.
   2. Minimum Base Metal Thickness: 0.0296 inch (0.75 mm) unless otherwise indicated..
   3. Depth: As indicated on Drawings.

2.03 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch (25 by 5 mm) by length indicated.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
   1. Depth: 2-1/2 inches (64 mm) unless otherwise indicated.

E. Furring Channels (Furring Members):
   1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
   2. Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Metal Thickness: 0.0296 inch (.75 mm).
      b. Depth: As indicated on Drawings.
   3. Equivalent Gauge Steel Studs and Runners: ASTM C 645.
      a. Minimum Base-Metal Thickness: 0.0296 inch (.75 mm).
      b. Depth: As indicated on Drawings.
      c. Product: ClarkDietrich ProSTUD/ProTRAK 20. (Basis of Design)
   4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
      a. Minimum Base-Metal Thickness: 0.0296 inch (.75 mm).
   5. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
      a. Configuration: Asymmetrical or hat shaped.

2.04 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.
   1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
   1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:
   1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
   2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.03 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.
   1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.04 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
   2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
   3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
   1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
   2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
      a. Install two studs at each jamb unless otherwise indicated.
      b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
      c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
   3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
   4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
      a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
   5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

6. Curved Partitions:
   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

D. Z-Furring Members: Install furring members as detailed or as required.
   1. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.05 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches (1219 mm) o.c.
   2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
   3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.
   6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

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. This Section includes the following:
   1. Interior gypsum board.

B. Related Sections include the following:
   1. Division 05 Section "Cold-Formed Metal Framing" for non-load-bearing steel framing that supports gypsum board.
   2. Division 07 Section "Thermal Insulation" for batt insulation and sound attenuation installed in assemblies that incorporate gypsum board.
   3. Division 07 Section "Joint Sealants" for acoustical sealants installed in assemblies that incorporate gypsum board.
   4. Division 09 Section "Non-Load-Bearing Steel Framing" for non-structural framing and suspension systems that support gypsum board.
   5. Division 09 "Interior Painting" for primers applied to gypsum board surfaces.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For the following products:
   1. Trim Accessories: Full-size Sample in 12 inch (300 mm) long length for each trim accessory indicated.

1.04 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.05 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.01 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.02 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
   1. 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:
      a. G-P Gypsum.
      b. National Gypsum Company.
      c. USG Corporation.

B. Regular Type:
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

C. Type C:
   1. Thickness: 1/2 inch (12.7 mm).
   2. Long Edges: Tapered.

D. Type X:
   1. Thickness: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
   1. Thickness: 1/2 inch (12.7 mm).
   2. Long Edges: Tapered.

F. Acoustical Sound Dampening Wall and Ceiling Board: Two layers of heavy paper faced, high density gypsum board separated by a viscoelastic polymer layer and capable of achieving STC rating of 50 or more in typical stud wall assemblies as calculated in accordance with ASTM E413 and when tested in accordance with ASTM E90.

G. Noise-Reducing Gypsum Board:
   1. Thickness: 1/2 inch (13 mm).
   2. Long Edges: Tapered.
   3. Products:
      a. Certainteed; Silent FX QuickCut Type X: www.certainteed.com
      b. Substitutions: See Section 01 60 00 - Product Requirements.

H. Moisture Resistant Type at Ceramic Wall Tile: With moisture- and mold-resistant core and surfaces.
   1. Core: 5/8 inch (15.9 mm).
   2. Long Edges: Tapered.

2.03 EXTERIOR GYPSUM BOARD FOR SOFFITS

A. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Georgia-Pacific Gypsum; “DensGlass Sheathing" or a comparable product by one of the following:
      a. CertainTeed Corp.
      b. National Gypsum Company.
      c. USG Corporation.
   2. Core:1/2 inch, regular type.
   3. Edges: Square.

2.04 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
   2. Shapes:
      a. Cornerbead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound.

B. Exterior Soffit Vents: One piece, perforated, ASTM B221 6063 T5 alloy aluminum, with edge suitable for direct application to gypsum board and manufactured especially for soffit application. Provide continuous vent.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Fry Reglet Corp.; "V" Reveal (Basis of Design)
      b. Gordon, Inc.
      c. Pittcon Industries.
   2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
   3. Finish: Clear anodized unless otherwise indicated.

2.05 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Wallboard: Paper.
   2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
   2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
      a. Use setting-type compound for installing paper-faced metal trim accessories.
   3. Fill Coat: For second coat, use setting-type, sandable topping compound.
   4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Exterior Applications:
   1. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

2.06 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

C. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

D. Thermal Insulation and Sound Attenuation: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4 to 3/8 inch (6.4 to 9.5 mm) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4 to 1/2 inch (6.4 to 12.7 mm) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
   1. Regular Type: Vertical surfaces, unless otherwise indicated.
   2. Type C and X: Where required for fire-resistance-rated assembly.
   3. Ceiling Type: Ceiling surfaces.
   4. Noise-Reducing Type: As indicated on the Drawings.
   5. Moisture-Resistant Type: Ceramic wall tile applications.

B. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.04 APPLYING EXTERIOR GYPSUM PANELS FOR SOFFITS

A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
   1. Install with 1/4 inch (6.4 mm) open space where panels abut other construction or structural penetrations.
   2. Fasten with corrosion-resistant screws.

3.05 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints Locations: Gypsum board surfaces shall be isolated with control joints where:
   1. Ceiling abuts a structural element, dissimilar wall or other vertical penetration.
   2. Construction changes within the plane of the partition or ceiling.
   3. Ceiling dimensions exceed 30 feet in either direction.
   4. Partition or furring abuts a structural element or dissimilar wall or ceiling.

C. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners, unless otherwise indicated.
   2. LC-Bead: Use at exposed panel edges.
   3. L-Bead: Use where required.

D. Exterior Soffit Vents: Install according to manufacturer's written instructions and in locations indicated on drawings. Provide vent area specified.

E. Exterior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.
   2. LC-Bead: Use at exposed panel edges.

F. Aluminum Reveals and Trim: Install in locations indicated on Drawings.

3.06 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
      a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.

3.07 IDENTIFICATION OF SMOKE AND FIRE RATED WALLS

A. In accordance with building codes, provide proper identification of smoke and fire rated walls above all ceilings. Wall identification for both smoke and fire ratings shall be on both sides of wall. Identification shall be permanently stenciled as approved by the Architect.

3.08 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Ceramic accessories.

D. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium).

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar.

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.

D. ANSI A108.1c - Specifications for Contractors 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 Bed with Dry-Set or Latex-Portland Cement.

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive.

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar.

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy.

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout.

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework.

K. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior glue plywood) Latex-Portland Cement Mortar.

L. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.

M. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar.

N. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation.

O. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation.

P. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation.

Q. ANSI A137.1 - American National Standard Specifications for Ceramic Tile.

R. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles.

S. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation.

1.04 SUBMITTALS

A. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

B. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Tile: 2 percent of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.

PART 2 - PRODUCTS

2.01 TILE

A. Quarry Tile: ANSI A137.1, standard grade.
   1. Moisture Absorption: 0.5 to 3.0 percent as tested in accordance with ASTM C373.
   2. Size: 6 by 6 inch (152 by 152 mm), nominal.
   3. Thickness: 1/2 inch (12.7 mm), nominal.
   4. Edges: Cushioned.
   5. Surface Finish: See Finish Legend.
   6. Color(s): See Finish Legend.
   7. Trim Units: Matching cove base shapes in sizes coordinated with field tile.
   8. Products: See Finish Legend.

B. Ceramic Wall Tile: ANSI A137.1, standard grade.
   1. Size: See Finish Legend.
   2. Edges: Cushioned.
   3. Surface Finish: See Finish Legend.
   4. Color: See Finish Legend.
   5. Trim Units: Matching bullnose shapes in sizes coordinated with field tile.
   6. Products: See Finish Legend.
      a. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

B. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications: See Finish Legend.
   2. Manufacturers:
      a. Schluter-Systems; Product Schiene: www.schluter.com. (Basis of Design)
      b. Genesis APS International: www.genesis-aps.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 SETTING MATERIALS

A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Applications: Use this type of bond coat where indicated.
   2. Products: See Finish Legend.
      a. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GROUTS

A. Standard Grout: ANSI A118.6 standard cement grout.
   1. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   2. Color(s): See Finish Legend.
   3. Products:
      a. Custom Building Products: www.custombuildingproducts.com.
      b. LATICRETE International, Inc: www.laticrete.com.
      c. ProSpec, an Oldcastle brand: www.prospec.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.05 MAINTENANCE MATERIALS

A. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
   1. Composition: Water-based colorless silicone.

2.06 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Thickness: 20 mils (0.5 mm), maximum.
   2. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum.
   3. Products:
      a. LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
      b. Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
      c. Proflex Products, Inc: www.proflex.us.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Waterproofing Membrane: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Fluid or Trowel Applied Type:
      a. Products:
         1) ARDEX Engineered Cements: www.ardexamericas.com.
         2) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
         3) Merkrete, by Parex USA, Inc: www.merkrete.com/sle.
         4) Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

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 tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

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.

3.03 INSTALLATION - GENERAL

A. Install tile and grout in accordance with applicable requirements of ANSI A108.1A thru A108.13, 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 floor 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 bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Install non-ceramic trim in accordance with manufacturer's instructions.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar and grout.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints.

L. 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 - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

1. At elevated tile floors, provide waterproofing membrane and install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.05 INSTALLATION - WALL TILE

A. Over gypsum wallboard on metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

3.06 CLEANING

A. Clean tile and grout surfaces.

3.07 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Acoustical insulation.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

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.

1.04 SUBMITTALS

A. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

B. Samples: Submit two full size samples illustrating material and finish of acoustical units.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.05 QUALITY ASSURANCE

A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Panels: See Finish Legend.
   1. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACOUSTICAL UNITS

A. See Finish Legend.

2.03 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension Systems: See Finish Legend.

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. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Acoustical Insulation: Specified in Section 07 21 00.

D. Acoustical Sealant For Perimeter Moldings: Specified in Section 07 92 00.

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 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. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

D. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

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 (150 mm) of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

I. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Use longest practical lengths.
   2. Overlap and rivet corners.

3.03 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 units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 51 29

CEMENTITIOUS WOOD FIBER CEILING PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Cementitious wood fiber plank acoustical ceiling panels.

B. Trim and miscellaneous accessories.

1.02 REFERENCES

A. ASTM International:
   1. ASTM C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
   2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E1264 Standard Classification for Acoustical Ceiling Products.

B. Ceilings and Interior Systems Construction Association (CISCA):
   1. CISCA Code of Practices.

1.03 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Provide acoustical panel assembly designed and tested to provide surface burning characteristics (ASTM E84) as follows:
      a. Flamespread: 0.
      b. Smoke Developed: 0.
   2. Provide acoustical panel system which has been manufactured, fabricated and installed to provide Noise Reduction Coefficient (NRC) rating as follows:
      a. See Finish Legend.

1.04 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.

B. Product Data: Submit manufacturer’s product data and installation instructions.
   1. Recommended procedures for normal cleaning and removal of stains including precautions in use of cleaning materials that may be detrimental to surfaces.

C. Samples: Submit selection and verification samples: 6 inch × 6 inch (152 × 152 mm) sample panel unit required, showing full range of exposed texture to be expected in completed work.

D. Quality Assurance/Control Submittals: Submit the following:
   1. Test Reports: Upon request, submit certified test reports from recognized test laboratories.
   2. Certificates: Submit manufacturer’s certificate that products meet or exceed specified requirements.

1.05 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirement Section.

B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
   1. Prevent soiling, physical damage or wetting.
   2. Store cartons open at each end to stabilize moisture content and temperature.

1.06 PROJECT/SITE CONDITIONS

A. Environmental Requirements:
   1. Do not install acoustical panels until building is closed in and HVAC system is operational.

2. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
3. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
   a. Relative Humidity: 65 - 75%.
   b. Uniform Temperature: 55 - 70 degrees F (13 - 21 degrees C).

1.07 WARRANTY

A. Provide acoustical panel manufacturer's standard written ten-year limited warranty from the date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Armstrong: www.armstrong.com. (Basis of Design)

B. Tectum: www.tectum.com.

C. USG Corporation: www.usg.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACOUSTICAL PANELS

A. Acoustical Ceiling Panels:
   1. Surface Texture: Coarse
   2. Composition: Aspen wood fibers bonded with inorganic hydraulic cement
   3. Color: Tectum White
   4. Size: 48 in x 96 in
   5. Thickness: 2 in
   6. Edge Profile: Square
   7. Noise Reduction Coefficient(NRC): 0.60
   8. Flame Spread: ASTM E 1264; Class A
   9. Light Reflectance (LR) White Panel: ASTM E 1477; 0.75
   10. Dimensional Stability: HumiGuard Plus
   11. Mounting: D-20. Provide all fasteners and furring strips.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that layout of hangers will not interfere with other work; make adjustments in layout as necessary.

B. Do not begin ceiling installation until services above ceiling are complete except for final trim.

C. Notify Architect of unsatisfactory conditions before proceeding.

3.02 PREPARATION

A. Lay out system to a balanced grid design, with edge units not less than 50 percent of acoustical unit size.

B. Locate system on room axis according to reflected ceiling plan.

3.03 INSTALLATION OF ACOUSTICAL PANELS

A. Install acoustical panels in accordance with manufacturer's written instructions for D-20 Mounting.

B. Installation Tolerance: Maximum variation from flat and level surface is 1:360.

3.04 CLEANING AND PROTECTION

A. Clean exposed surfaces of acoustical panel ceilings, including suspension system and edge trim, complying with manufacturer's written instructions for cleaning of minor finish damage.

Replace acoustical panels that cannot be cleaned to an appearance matching unmarred panels.

B. Protect installed acoustical panel ceilings until completion of project.

END OF SECTION

SECTION 09 64 66

WOOD ATHLETIC FLOORING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide athletic flooring in the gymnasium

B. Related work specified under other sections.
   1. Cast-In-Place Concrete - Section 03 30 00.
      a. Concrete Slab Depression: 3 inch (76mm) using 25/32 inch (20mm) flooring and subfloor.
      b. Surface Finish: steel troweled and finished smooth.
      c. Concrete Tolerance: +/- 1/8 inch (3mm) in radius of 10 feet (3m).
      d. Floor Flatness and Floor Levelness (FF and FL) numbers are not recognized.
      e. Compressive Strength: Concrete shall be a minimum of 3,000 psi (21 MPa) and a maximum of 4000 psi (28MPa) compressive strength after 28 days. Concrete shall be free of washed river gravel, pea gravel, flint or hardener additives. No lightweight concrete.
      f. High spots shall be ground level and low spots shall be filled in with approved leveling compound by the general contractor to meet the tolerance above.
   2. Under-Slab Vapor Barrier - Section 03 30 00.
      a. Concrete subfloors on or below grade shall be adequately waterproofed beneath the slab and at the perimeter walls and on the earth side of below grade walls by general contractor using suitable type membrane.
      b. Sand-Poly-Sand slab construction is not an acceptable construction.
   3. Game Standard Inserts - Section 11 66 23.

1.02 REFERENCES

A. MFMA - Maple Flooring Manufacturers Association

B. MFMA PUR - Performance Uniformity Requirements

C. DIN 108032 (part 2) 2001 - Performance Test

D. DIN 108032 (part 2) 1991 - Performance Test

E. ASTM F2772 - Athletic Performance Properties of Indoor Sports Floor Systems

F. EN 14904 - European Committee for Standardization - Surfaces for Sports areas

G. ASTM F2772 - Athletic Performance Properties of Indoor Sports Floor Systems

H. FIBA - International Basketball Federation

I. FSC - Forest Stewardship Council

1.03 QUALITY ASSURANCE

A. Floor System Manufacturer Qualifications
   1. Manufacturer shall be an established firm experienced in field and have been in business or a minimum of ten (10) years.
   2. Manufacturer will be a member in good standing of the Maple Flooring Manufacturers Association (MFMA).

B. Floor Contractor/Installer Qualifications and Certifications
   1. The flooring contractor shall be a flooring manufacturer's approved installer with MFMA Accredited Installer(s) on-site for the duration of the wood floor installation; or, a contractor approved by the flooring manufacturer.
   2. Flooring contractor shall submit a list of at least three completed projects of similar magnitude and complexity completed under current corporate identity.

C. Surface Appearance:
   1. Expansion spaces will not exceed 1/64 inch (0.4mm) at time of installation and will be spread evenly across the floor with each row of flooring.
   2. Expansion spacing will be installed to allow for normal expected increases in Equilibrium Wood Moisture Content (EMC).

D. Floor System Performance
   1. Flooring shall meet or exceed criteria of the following performance criteria:
      a. MFMA PUR
      b. DIN 18032 Part2 2001
      c. DIN 18032 Part2 1991
      d. ASTM F2772 Sport Floor Standards
      e. FIBA International Standards
      f. EN 14904 Standards
   2. Independent testing report showing the system passing all criteria shall be provided as part of the bid qualification process and submittal process.

1.04 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor assembly and accessory. Include plans, sections, and attachment details. Include expansion provisions and trim details.

C. Samples: For each exposed product and for each color and texture specified, approximately 12 inches (300 mm) long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

D. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and finishes available for wood flooring.
   1. Include Samples of accessories involving color and finish selection.

E. Samples for Verification: For wood flooring and accessories, with stain color and finish required, approximately 12 inches (300 mm) long and of same thickness and material indicated for the Work and showing the full range of normal color and texture variations expected.

F. Concrete Guidelines
   1. Submit MFMA Recommendations for correct preparation, finishing and testing of concrete subfloor surfaces to receive wood flooring.

G. Maintenance Guidelines
   1. Submit copy of Maintenance Instructions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials
   1. Materials shall not be delivered, stored or installed until all masonry, painting, tilework, work is complete, and all overhead mechanical work, lighting, backstops, scoreboards are installed. Room temperature of 55-80 degrees Fahrenheit (13 to 27 degrees Celsius) and relative humidity of 35-50 % are to be maintained. In- Slab Relative Humidity shall be 85% or less using ASTM F 2170 In-Slab Relative Humidity test. Ideal installation/storage conditions are the same as those that will prevail when building is occupied
   2. Materials shall not be stored at the installation location if the In-Slab relative humidity level for the concrete slab is above 85% using ASTM F 2170 In-Slab Relative Humidity test.

1.06 JOB CONDITIONS-SEQUENCY

A. Do not install floor system until concrete has been cured 60 days and the requirements in Paragraph 1.05 are obtained.

B. General Contractor is responsible to ensure slab is clean and free of all dirt and debris prior to floor installation beginning.

C. Permanent heat, light and ventilation shall be installed and operating during and after installation. Maintain a temperature range of 55 to 80 degrees Fahrenheit (13 to 27 degrees Celsius) and a relative humidity range of 35 to 50%. Consult MFMA guidelines for further information.

D. After floors are finished, area to be kept locked by general contractor to allow curing time for the finish. If after required curing time general contractor or owner requires use of gym, he shall protect the floor by covering with non-fibered kraft paper or red rosin paper with taped joints, until acceptance by owner (or owner's agent) of complete gymnasium floor.

1.07 WARRANTY

A. Flooring manufacturer hereby warrants the material to be free from manufacturing defects for a period of one year from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Wood Athletic Flooring:
   1. Action Floor Systems; Action Power Channel: www.actionfloors.com.
   2. Connor Sports; PermaflexII: www.connersports.com.
   3. Robbins Sports Surfaces; Bio-Channel Classic: www.robbinsfloor.com. (Basis of Design)

2.02 MATERIAL

A. Vapor Barrier
   1. 6-mil polyethylene.

B. Subfloor
   1. 9/16 inch shock pad.
   2. Flooring manufacturer's Subfloor panels that have been factory prepared to accept anchor channel.
   3. Metal Anchor Channels.

C. Maple Flooring Manufacturers Association(MFMA) Wood Flooring
   1. Specie: Northern Hard Maple
   2. Seasoning: Kiln Dried
   3. Matching: Tongue and groove on side-match and end-match.
   4. Pattern: Straight-lay (One directional)
   5. Thickness: 25/32 inch
   6. Width: 2 ¼ inch
   7. Grade: 2nd and Better
   8. Expansion Option: Standard
   9. Wood Finish: 2.
   10. Factory Finish: Unfinished
   11. Treatment: Un-Treated

D. Fasteners
   1. Flooring 1 3/4 inches (44mm) barbed cleats or staples.
   2. Channel anchors - 2 inch power anchors.

E. Finishing materials
   1. MFMA approved oil-modified Sealer
   2. MFMA approved oil-modified Finish

F. Gamelines
   1. Gameline paint(s) shall be recommended by the finishing material's manufacturer and must be compatible with the finish.

G. Perimeter
   1. 3 x 4 inch ventilating type. Black or brown as selected by the Architect.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect concrete slab for proper tolerance and dryness and report any discrepancies to the general contractor and architect in writing. Slab will be level to within 1/8 inch (3mm) in a 10 foot (3m). Moisture content of the concrete slab shall not exceed 85% using ASTM F 2170 In-Slab Relative Humidity test.

B. All work required to put the concrete subfloors in acceptable condition shall be the responsibility of the general contractor.

C. Subfloor shall be broom cleaned by general contractor.

D. Installer shall document all working conditions provided in General Specifications prior to commencement of installation.

3.02 INSTALLATION

A. Vapor Barrier:
   1. Install polyethylene with joints lapped a minimum of 6 inches (150mm) and turned up 4 inches (100mm) at the walls.

B. Subfloor:
   1. Install shock absorbing pad per manufacturer's recommendations over 6 mil poly.
   2. Following manufacturer's guidelines, place subfloor assembly in end-to-end manner, staggering end joints in adjacent rows. Allow for a ¼ inch (6mm) gap between panels. Panels shall be placed on a 45 degree angle to the direction of the maple flooring. Provide 1-½ to 2 inches (40 to 50mm) expansion void at the perimeter and all vertical obstructions.
   3. Install solid blocking at doorways, under bleachers in the stacked position, and below portable goals.
   4. Install bleacher blocking per manufacturer's recommendations.
   5. Place metal anchor channel in each factory-prepared location in the panel.
   6. Anchor each anchor channel in the center pre-routed hole only, unless trimming at wall or vertical obstruction requires relocation in adjacent location to anchor.

C. Flooring:
   1. Machine nail maple finish flooring 10 to 12 inches (150mm to 200mm) O.C. with end joints properly driven up and proper spacing provided for humidity conditions in specific regions. Provide 2 inch (50mm) expansion voids at the perimeter and at all vertical obstructions.

3.03 FINISHING

A. Sanding
   1. Sand per manufacturer's recommendations.
   2. After sanding, buff entire floor using 100 grit screen or equal grit sandpaper, with a heavy-duty buffing machine.
   3. Inspect entire area of floor to insure the floor presents a smooth surface without drum stop marks, gouges, streaks or shiners.
   4. Vacuum and/or tack floor before first coat of seal.
   5. Floor should be clean and completely free of dirt and sanding dust.

B. Gymnasiums:
   1. Apply specified combination of seal, gameline paint, and finish in accordance with manufacturer's instructions.
   2. Buff and vacuum and/or tack between each coat after it dries.
   3. Apply game lines accurately after the buffing and vacuuming the coated surfaces. Game lines shall be painted between seal coats and finish coats. Layout in accordance with drawings. For game lines, use current rules of association having jurisdiction. Lines shall be straight with sharp edges in colors selected by architect.

3.04 WALL BASE INSTALLATION

A. Install vent cove base anchored to walls with base cement or screws. Use pre-molded outside corners and neatly mitered inside corner.

3.05 CLEANING

A. Clean up all unused materials and debris and remove it from the premises.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Resilient stair accessories.
   3. Resilient molding accessories.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.03 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. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.05 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C)or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Project Acceptance, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.01 THERMOSET-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Johnsonite (Basis of Design)
   2. Flexco.
   3. Mannington
   4. Roppe Corporation, USA .

B. Product Standard: ASTM F 1861, Type TP (rubber, thermoset), Group I (solid, homogeneous).
   1. Style and Location: See Finish Legend.

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm) and 6 inches (153 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Job-formed outside corners.

G. Inside Corners: Job-formed.

H. Colors: See Finish Legend.

2.02 RUBBER STAIR ACCESSORIES

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. Burke Mercer Flooring Products, Division of Burke Industries Inc.
   3. Flexco.
   4. Johnsonite; A Tarkett Company. (Basis of Design)
   5. Mannington Mills, Inc.
   6. Nora Systems, Inc.
   7. Roppe Corporation, USA.

C. Stair Treads: See Finish Legend.

D. Separate Risers: Smooth, flat; in height that fully covers substrate; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.
   1. Style: Coved toe, 7 inches (178 mm) high by length matching treads.
   2. Thickness: 0.125 inch (3.2 mm).

E. Landing Tile: Matching treads; produced by same manufacturer as treads and recommended by manufacturer for installation with treads.

F. Locations: Provide rubber stair accessories in areas indicated.

G. Colors and Patterns: See Finish Legend.

2.03 RUBBER MOLDING ACCESSORY

A. Profile and Dimensions: As indicated.

B. Locations: Provide rubber molding accessories in areas indicated or required.

C. Colors and Patterns: See Finish Legend.

2.04 INSTALLATION MATERIALS

A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 10 pH.
   4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
      a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

3.03 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm).
      a. Miter corners to minimize open joints.

3.04 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Stair Accessories:
   1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
   2. Tightly adhere to substrates throughout length of each piece.
   3. For treads installed as separate, equal-length units, install to produce a flush joint between units.

C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.05 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum horizontal surfaces thoroughly.
   3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Luxury vinyl floor tile.
   2. Vinyl composition floor tile.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
   1. Show details of special patterns.

C. Samples: Full-size units of each color and pattern of floor tile required.

D. Samples for Verification: Full-size units of each color and pattern of floor tile required.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile 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.
   1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
   1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store floor tiles on flat surfaces.

1.08 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive floor tile during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Project Acceptance, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.02 LUXURY VINYL FLOOR TILE (LVT)

A. Products: Subject to compliance with requirements, provide tile indicated on the Finish Specifications.
   1. Amtico.
   2. Armstrong World Industries, Inc.
   3. Johnsonite; A Tarkett Company.
   4. Mannington.

B. Tile Standard: ASTM F 1700.
   1. Class: Class III, printed film vinyl tile.
   2. Type: A, smooth surface.

C. Thickness: .120 inch.

D. Wear Layer: 20 mil.

E. Size: As indicated on the Finish Schedule.

F. Colors and Patterns: See Finish Schedule.

2.03 VINYL COMPOSITION FLOOR TILE (VCT)

A. Products: See Finish Legend.

B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.

C. Wearing Surface: Smooth.

D. Thickness: 0.125 inch (3.2 mm).

E. Size: 12 by 12 inches (305 by 305 mm).

F. Colors and Patterns: See Finish Legend.

2.04 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.04 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
   1. Lay tiles in pattern indicated.

C. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

E. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.05 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Sweep and vacuum surfaces thoroughly.
   3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

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. This Section includes modular, tufted carpet tile.

B. Related Sections include the following:
   1. Division 09 Section "Tile Carpeting (Walk-Off) Mat."

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate.

B. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern type, location, and direction.
   6. Pile direction.
   7. Type, color, and location of edge, transition, and other accessory strips.
   8. Transition details to other flooring materials.

C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
   1. Carpet Tile: Full-size Sample.
   2. Exposed Edge, Transition, and other Accessory Stripping: 12 inch (300 mm) long Samples.

D. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

E. Warranty: Special warranty specified in this Section.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104, Section 5, "Storage and Handling."

1.05 PROJECT CONDITIONS

A. Comply with CRI 104, Section 7.2, "Site Conditions; Temperature and Humidity" and Section 7.12, "Ventilation."

B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.06 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, and delamination.
   3. Warranty Period: 10 years from date of Substantial Completion.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

PART 2 - PRODUCTS

2.01 CARPET TILE

A. Provide carpet tile indicated on the Finish Legend.

2.02 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.

B. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm), unless more stringent requirements are required by manufacturer's written instructions.

C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.03 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

3.04 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION

SECTION 09 68 13.13

TILE CARPETING (WALK-OFF) MAT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, loose laid with edges and control grid adhered.

1.02 REFERENCES

A. CRI 104 - Standard for Installation of Commercial Textile Floorcovering Materials; Carpet and Rug Institute.

1.03 SUBMITTALS

A. Shop Drawings: Indicate layout of joints.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Maintenance Data: Provide three (3) copies of a printed maintenance manual written by the Carpet Manufacturer. Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

1.05 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide one full box of carpet tiles or 5%, whichever is greater, of each color and pattern selected.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Carpet Tile (Walk-Off Mat): See Finish Legend.

2.02 ACCESSORIES

A. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications: Carpet tile transition with other flooring surfaces.
   2. Manufacturers:
      a. Schluter-Systems; Product Schiene: www.schluter.com. (Basis of Design)
      b. Genesis APS International: www.genesis-aps.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Contact Adhesive: Compatible with carpet material, releasable type.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.

B. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

C. Vacuum clean substrate.

3.03 INSTALLATION

A. Carpet shall be installed in strict accordance with manufacturer's printed instructions.

B. Install carpet under open-bottom obstructions and under removable flanges and furnishings and into alcove and closets of each space.

C. Provide cut outs where required. Carpet tiles that are cut shall be anchored with adhesive.

D. Run carpet under open-bottom items such as heating convectors and install tight against walls, columns and cabinets sot that the entire floor area is covered with carpet. Cover over all floor type door closers.

E. Install edging at all openings and doors wherever carpet terminates, unless indicated otherwise.

F. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed.

G. Edges shall be butted together with the proper pressure to produce the tightest joint possible without distortion.

H. All carpet shall be installed quarter-turned.

I. Align all carpet tiles where they meet and use leveling compound where necessary. Any floor filling or leveling shall have a minimum of 4 feet of feather.

J. Tightness: The accumulated space gained as a result of loose joints shall not be greater than 1/4 inch measured over eleven tiles.

K. Expansion Joints: Do not bridge building expansion joints with continuous carpeting. Provide for movement.

L. All carpet tiles shall be installed with arrows in one direction.

M. Install carpet tiles in the following locations with 100% adhesive coverage:
   1. Perimeters of spaces.
   2. All cut tiles.

N. Apply a strip adhesive along each side of feeder duct covers to anchor carpet tiles adjacent to cover plates.

O. Spread adhesive using a roller with 1 inch nap or with trowel as applicable.

P. Check the tightness of the joints as work progresses and adjust as necessary. Align and butt joints according to carpet manufacturer's instructions.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 77 25

FIBERGLASS REINFORCED PLASTIC PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced composite panels and base.

B. Trim and installation accessories.

1.02 RELATED SECTIONS

A. Section 07 92 00 - Joint Sealants.

B. Section 09 29 00 - Gypsum Board.

1.03 REFERENCES

A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

B. ASTM D 149 - Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.

C. ASTM D 256 - Standard Test Methods for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

D. ASTM D 543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.

E. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.

F. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

G. ASTM D 696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30 degrees C and 30 degrees C.

H. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

I. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

J. ASTM D 2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

K. ASTM D 3841 - Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels.

L. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard details and catalog data demonstrating compliance with referenced standards. Provide installation instructions.

B. Samples:
   1. Submit 6 inch (300 mm) square samples of each surface and color required.
   2. Submit 6 inch (300 mm) long samples of each trim profile and trim color required.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products indoors and protect from moisture, construction traffic, and damage.

B. Store panels flat on clean, dry surface. Do not stand on edge or stack on fresh concrete or other surfaces that emit moisture.

C. Store panels for at least 24 hours at temperature and humidity conditions approximating the average environment of the finished room.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. "Glasbord"; Crane Composites: www.cranecomposites.com

B. "Kal-Lite"; Kalwal Corp: www.kal-lite.com.

C. "Marlite"; Marlite Division: www.marlite.com. (Basis if Design)

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PANEL MATERIALS

A. General:
   1. Composite plastic panels of random chopped fiber glass roving, modified polyester copolymer, inorganic fillers, and pigments.
   2. Resistant to rot, corrosion, staining, denting, peeling, and splintering.
   3. USDA accepted.
   4. Comply with ASTM D 3841, Type CC2.

B. Composite Wall Panels:
   1. Surface burning classification: Class C.
      a. Flame spread (ASTM E 84): 200 or less.
      b. Smoke developed (ASTM E 84): 450 or less.
   2. Flexural strength (ASTM D 790): 8,830 psi (60.88 MPa).
   3. Modulus of Elasticity (ASTM D 790): 260 ksi (1790 MPa).
   4. Tensile strength (ASTM D 638): 5,700 psi (39.3 MPa).
   5. Modulus of Elasticity (ASTM D 638): 550 ksi (3791 MPa).
   6. Impact strength, IZOD (ASTM D 256): 7.7 ft.lb/in (1.35 N/mm).
   7. Thermal Conductivity (ASTM C 177): 0.50 BTU/in/hr/sq ft deg F (0.07 W/m K).
   8. Barcol hardness (ASTM D 2583): 30.
   9. Water absorption (ASTM D 570): 0.16 percent in 24 hrs. @ 77 degrees F (25 K).
   10. Coefficient of linear thermal expansion (ASTM D 696): 0.00002 in/in/degrees F (0.000036 mm/mm/K).
   11. Specific gravity (ASTM D 792): 1.6-1.8.
   12. Dielectric Strength (ASTM D 149): 400 volts/mil.
   13. Chemical resistance (ASTM D 543): 1) Reagent, 2) Weight increase after immersion (percent), 3) Weight increase after reconditioning (percent), 4) Appearance change:
      a. Distilled water: 0.59, 0.19, No change.
      b. Ethyl alcohol, 95 percent: 0.92, 0.18, Some fibers showing.
      c. Sulfuric acid, 3 percent: 0.43, 0.08, Some fibers showing.
      d. Sulfuric acid, 30 percent: 0.28, 0.13, Some fibers showing.
      e. Sodium hydroxide, 1 percent: 0.63, 0.12, Some fibers showing.
      f. Sodium hydroxide, 10 percent: 0.26, 0.17, Some fibers exposed, reduction in glass.
      g. Toluene: 0.14, 0.13, Few fibers showing.
      h. Sodium chloride, 1 percent: 0.43, 0.18, No change.
      i. Hydrochloric acid, 10 percent: 0.24, 0.01, Few fibers showing.
      j. Chlorine Gas: NC, NC, No change (NC).
      k. Hydrogen sulfide: NC, NC, No change (NC).
      l. No dimensional change under any of the listed reagents.

C. Size:
   1. Wall panel width: 48 inches (1.22 m).
   2. Wall panel length: 96 inches (2.44 m).
   3. Wall panel length: Provide full-length panels unless substrate dimensions exceed available fabricated size.
   4. Thickness: 3/32 inch.

5. Dimensional Tolerances:
   a. Width and length: +/- 1/8 inch (3.2 mm).
   b. Thickness: +/- 10 percent.
   c. Squareness: Not more than 1/8 inch (3.2 mm) out of square.

2.03 FINISHES

A. Exposed Surface: See Finish Legend.

B. Back Surface: Smooth. Imperfections that do not affect functional properties are not cause for rejection.

C. Color: See Room Finish Schedule.

2.04 TRIM ACCESSORIES

A. Provide panel manufacturer's standard vinyl moldings to meet project conditions.

B. Base: Manufacturer's standard 4 inch base.

C. Fasteners: Non-staining nylon drive rivets.
   1. Match panel colors.
   2. Length to suit project conditions.

D. Adhesive: Structural construction adhesive as recommended by manufacturer.

E. Sealant: Clear silicone sealant as recommended by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates that will receive panels to ensure that surfaces are smooth, dry, true, and free of dirt, dust, oil, or grease.

B. Remove high spots. Fill low spots.

C. Apply leveling coat of plaster to concrete block walls, if required to bring surface to a true plane.

D. Verify that substrate construction is completed and approved.

E. Correct deficiencies in substrate before installing panels.

3.02 INSTALLATION

A. Install in accordance with manufacturer's printed installation instructions, using both mechanical fasteners and adhesive.

B. Cutting Panels:
   1. Cut panels with carbide-tipped saw blade or swivel head shear.
   2. Allow 1/2 inch (13 mm) clearance in length per 8 foot (2.44 m) panel length.
   3. Allow 1/8 inch (3.2 mm) clearance at cut-outs for penetrations.

C. Pre-drill fastener holes before applying adhesive. Use carbide-tipped drill.
   1. Drill 3/8 inch (9.5 mm) holes for 1/4 inch (6.4 mm) nominal fasteners.
   2. Space at 8 inches (203 mm) maximum on center at perimeter, approximately 1 inch (25 mm) from panel edge.
   3. Space at in field in rows 16 inches (406 mm) on center, with fasteners spaced at 12 inches (305 mm) maximum on center.

D. Apply adhesive at temperature between 50 and 90 degrees F (10 and 32 degrees C), unless otherwise approved.
   1. Spread adhesive 1/4-inch (6.4 mm) deep over entire back side of panel to achieve 100 percent coverage.
   2. Do not use beads of adhesive.
   3. Do not use mechanical fasteners or adhesive alone.
   4. Allow open time recommended by adhesive manufacturer before setting panels into position.
   5. Once in position, apply sufficient pressure to make full contact between panel and wall.

6. Roll panel surface to ensure complete contact.
7. If necessary, install bracing to maintain intimate contact until adhesive cures in accordance with manufacturer's instructions.

E. Panel Fasteners:
1. Apply silicone sealant in pre-drilled fastener holes.
2. Drive fasteners for snug fit. Do not over-tighten.
3. Fasten leading edge of each panel after installing moldings.

F. Moldings:
1. Trim division bar to accommodate ceiling and base moldings.
2. Apply bead of silicone sealant to one side of division bar and install on leading edge of first panel.
3. Push molding all the way onto panel and pull back to allow 1/8 inch (3.2 mm) clearance.
4. Check plumb.
5. Fasten molding with coated lath nails, installed to leading edge of molding, only.
6. Complete fastening of panel, and remove excess sealant.
7. Apply sealant to leading edge of molding to receive next panel. Allow 1/8 inch (3.2 mm) clearance when installing panel.
8. Remove excess sealant from panels and moldings.

G. Sealants: Seal corner seams, ceiling and base junctures, around door frames and other openings, and between penetrating items and panel cut-outs.

3.03 ADJUST AND CLEAN

A. Remove scraps and debris from the site, and leave in a neat and clean condition.

END OF SECTION

SECTION 09 84 30

ACOUSTICAL WALL PANEL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This section includes Metal Wall Panels as shown on the architectural drawings.

1.02 SUBMITTALS

A. Manufacturer's Literature and Data:
   1. Product Data: Submit manufacturer's technical data and brochures for specified system.

B. Shop Drawings:
   1. Shop drawings shall show dimensions, sizes, thickness, finishes, joining, mounting attachments, and relationship to adjoining work.

C. Samples:
   1. Samples shall include a minimum 12" X 12" nominal piece of each type of metal, finished as specified, and accessories.

D. Certification:
   1. Submit certification from manufacturer of wall panels attesting that products comply with specified requirements including finish as specified.

E. Qualification Data:
   1. Firms specified in "Quality Assurance" Article must demonstrate their capabilities and experience by including lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Product Test Reports:
   1. All products furnished shall have a flame spread classification of 0-25 for a Class A or Class 1 rating in accordance with ASTM E84.
   2. All products furnished shall be tested in accordance with ASTM C-423-90 for Sound Absorption. Test results for a Type A mounting method shall yield an NRC (Noise Reduction Coefficient) of no less than 1.0. Test results for a Type D-100 mounting method shall yield an NRC (Noise Reduction Coefficient) of no less than 1.15.

G. Maintenance Data:
   1. Provide maintenance instructions for acoustical panels to be included in maintenance manufals as specified in Division One.

H. Warranty:
   1. Provide product warranty for one year from date of Final Acceptance.

1.03 QUALITY ASSURANCE

A. Manufacturer: Firm with manufacturing and delivery capacity required for the project, shall have successfully completed at least ten projects within the past five years, utilizing systems, materials and techniques as herein specified.

B. Fabricator must own and operate its own Manufacturing facilities for all metal components. Systems consisting of components from a variety of manufacturers will not be considered or accepted.

C. Manufacturer/Fabricator must own and operate its own Painting and Finishing facility to assure single source responsibility and quality control.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct testing indicated, as documented according to ASTM E 548.

1.04 DELIVERY, STORAGE & HANDLING

A. All materials shall be protected during fabrication, shipment, site storage and erection to prevent damage to the finished work from other trades. Store acoustical panels inside a well-ventilated area, away from uncured concrete and masonry, and protected from the weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. ALPRO Systems shall be manufactured by ALPRO Acoustical Systems, Division of Gordon, Inc., 5023 Hazel Jones Road, Bossier City, LA 71111, (888) 733-3836, FAX (800) 877-8746, www.alproacoustics.com, sales@alproacoustics.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SYSTEM DESCRIPTION

A. Wall Panel System shall be ALPRO Acoustical Systems. All panels, J trim perimeter, corner angles and Z furring, including acoustical component shall be provided as a complete package of this work.

2.03 MATERIALS

A. Mounting Accessories
   1. Extruded aluminum, brake form aluminum or brake formed steel as manufactured by ALPRO, Division of Gordon, Inc. Accessories shall include Z-furring, J Trim and inside/outside corner angles in a size and length to completely support and finish trim the wall panels as shown in elevations. All mounting accessories shall be finished to match corrugated ALPRO Wall Panels.
   2. Aluminum Extrusions shall be 6063-T6 alloy. (ASTM B 221, ASTM B 221 M)
   3. General: Provide metals free from surface blemishes where exposed to view in finished unit. Surfaces that exhibit pitting, seam marks, roller marks, stains, and discolorations, or other imperfections on finished units are not acceptable. All metal shall be of the highest grade -commercial type,

B. Metal Panels
   1. Choose from the following selections for exposed metal. Aluminum sheet shall be 3003-H14 alloy, minimum .020”, .032” recommended, (ASTM B 209). Galvanized steel sheet (ASTM A366/A 366M) shall be minimum of .0216” (26 gauge), .0276” (24 ga) recommended.
   2. The metal acoustical Wall Panels shall be corrugated using (Specified ALPROÒ Pattern Type) and perforated with 1/8” diameter holes on 21/64” staggered centers, approximately 13% open area.
   3. The panels shall be fabricated of stucco-embossed or smooth aluminum .032 inch.

C. Sound Absorption Material:
   1. Provide fiberglass 2 inches X 2 #. The fiberglass panel shall be wrapped in Class A, per ASTM E84, Black Polyethylene.

2.04 FINISHES

A. Powder Coat Finish:
   1. Panels & Accessories shall receive a micro-etched pretreatment prior to receiving an electrostatically applied powder coat paint finish.
   2. All cut edges, including perforated holes must be coated. Finish shall be cured and oven baked to insure paint adhesion and uniform surface hardness.
   3. Paint Color to be selected from Manufacturer's full line of colors.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine building structure scheduled to receive wall panel system for unevenness or irregularities that would affect quality and execution of work.

B. Tolerances:
   1. Install wall panel system with a maximum surface deviation of 1/8” in 4’-0”.

3.02 INSTALLATION

A. General: Comply with manufacturer’s printed instructions, governing regulations for Seismic Codes, and with the Ceiling & Interior Systems Construction Association standards applicable to work.

B. Space Enclosure: Do not install any work until space is enclosed and weatherproofed, wet-work in space is completed and nominally dry, work above ceilings is complete, and temperature and humidity is continuously maintained at values near those of final occupancy.

3.03 CLEANING

A. Clean all surfaces following installation.

B. Replace material having scratches, abrasions, or other defects, with unblemished panels, or suspension.

C. Maintenance per manufacturer’s finish maintenance instructions.

3.04 PROTECTION

A. Protection of Acoustical Systems from damage by other trades after installation to be provided by General Contractor.

END OF SECTION

SECTION 09 84 34

SOUND-ABSORBING CEILING UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing ceiling baffles.

B. Mounting accessories.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Product Data: Manufacturer's printed data sheets for products specified.

B. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.

C. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.04 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. Manufacturers:
   1. Armstrong; Product Soundsoak Baffles: www.armstrongceilings.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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.

C. Fabric-Covered Acoustical Ceiling Baffles:
   1. Baffle Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
   2. Baffle Size: 24 inches by 48 inches (610 mm by 1220 mm).
   3. Baffle Thickness: 2 inches (25.4 mm).
   4. Edges: Perimeter edges reinforced by a formulated resin hardener.
   5. Fabric: Woven polyester.
   6. Color: As selected by Architect from manufacturer's full range.
   7. Mounting: Vertically suspended from ceiling or structure by one edge of panel.

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.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.03 ACCESSORIES

A. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.
   1. Through-threaded eyelets bolted through concealed perimeter frame.
   2. Provide galvanized wire for suspension from ceiling at heights as indicated.

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. Suspend ceiling baffles at locations and heights as indicated.

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.

END OF SECTION

SECTION 09 91 13

EXTERIOR PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.

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. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 09 91 23 - Interior Painting.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

C. SSPC-SP 1 - Solvent Cleaning.

D. SSPC-SP 6 - Commercial Blast Cleaning.

1.04 SUBMITTALS

A. 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.

B. Samples: Submit two paper chip samples, 6 by 6 inch (152 by 152 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 5 gallons (20 L) of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 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 (7 degrees C) and a maximum of 90 degrees F (32 degrees C), 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 exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
   2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.

B. Paints:
   1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.
   2. Other Acceptable Manufacturers:
      a. PPG Paints: www.ppgpaints.com/sle.
      b. Pratt & Lambert Paints: www.prattandlambert.com.

2.02 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. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
   1) Opaque, Flat: 50 g/L, maximum.
   2) Opaque, Nonflat: 150 g/L, maximum.
   3) Opaque, High Gloss: 250 g/L, maximum.
   4) Varnishes: 350 g/L, maximum.
c. Architectural coatings VOC limits of North Carolina.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.

2.03 PAINT SYSTEMS - EXTERIOR

A. Gypsum Soffit Board, Opaque, Latex, 3 Coat:
1. Prime Coat: Primer, bonding, water-based: S-W PrepRite ProBlock Latex Primer/Sealer.
2. Intermediate Coat: Latex, exterior, matching topcoat.
3. Topcoat: Latex, exterior, semi-gloss: S-W Solo Acrylic Semi-Gloss, A76 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

B. Ferrous Metals, Unprimed, Latex, 3 Coat:
1. One coat of latex primer: S-W DTM Acrylic Primer/Finish, B66W1
2. Semi-gloss: Two coats of latex enamel; S-W DTM Acrylic Semi-Gloss Coating, B66-200 Series

C. Ferrous Metals, Primed, Latex, 2 Coat:
1. Touch-up with latex primer: S-W DTM Acrylic Primer/Finish, B66W1
2. Semi-gloss: Two coats of latex enamel; S-W DTM Acrylic Semi-Gloss Coating, B66-200 Series

D. Galvanized Metals, Latex, 3 Coat:
1. One coat galvanize primer; S-W DTM Acrylic Primer/Finish, B66W1
2. Semi-gloss: Two coats of latex enamel; S-W DTM Acrylic Semi-Gloss Coating, B66-200 Series

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. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

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. Fiber Cement Siding: 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 mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Exterior Gypsum Board: Fill minor defects with exterior filler compound. Spot prime defects after repair.

G. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

H. 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. Re-prime entire shop-primed item.
   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.

I. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Sand metal surfaces lightly between coats to achieve required finish.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. 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

SECTION 09 91 23

INTERIOR PAINTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and varnishes.

C. Materials for backpriming woodwork.

D. 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. Elevator pit ladders.
   3. 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.

E. 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. Floors, unless specifically indicated.
   6. Glass.
   7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 05 51 13 - Metal Pan Stairs: Shop-primed items.

C. Section 09 91 13 - Exterior Painting.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

D. SSPC-SP 1 - Solvent Cleaning.

E. SSPC-SP 6 - Commercial Blast Cleaning.

1.04 SUBMITTALS

A. 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.

B. Samples: Submit two paper chip samples, 6 by 6 inch (152 by 152 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.

C. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 5 gallons (20 L) of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.05 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 (7 degrees C) and a maximum of 90 degrees F (32 degrees C), 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 (3 degrees C) above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish Finishes: 65 degrees F (18 degrees C) for interior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
   2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
   3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.

B. Paints:
   1. Base Manufacturer: Sherwin-Williams Company: www.sherwin-williams.com.
      a. PPG Paints: www.ppgpaints.com/sle.
      b. Pratt & Lambert Paints: www.prattandlambert.com.

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. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Nonflat: 150 g/L, maximum.
         3) Opaque, High Gloss: 250 g/L, maximum.
      c. Architectural coatings VOC limits of North Carolina.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: See Finish Legend.
   1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.03 PAINT SYSTEMS - INTERIOR

A. Wood, Transparent, Varnish, No Stain:
   1. One coat sealer; S-W Wood Classics FastDry Sanding Sealer, B26V43
   2. Gloss: Two coats of varnish; S-W Wood Classics Fast Dry Varnish, Gloss A66V391
   3. Satin: Two coats of varnish; S-W Wood Classics FastDry Varnish, Satin A66 Series

B. Wood, Transparent, Varnish, Stain:
   1. One coat of stain; S-W Wood Classics Interior Oil Stain, A49 Series
   2. One coat sealer; S-W Wood Classics FastDry Sanding Sealer, B26V43
   3. Gloss: One coat of varnish; S-W Wood Classics Fast Dry Varnish, Gloss A66V391
   4. Satin: One coat of varnish; S-W Wood Classics FastDry Varnish, Satin A66 Series

C. Ferrous Metals, Unprimed, Latex, 3 Coat:
   1. One coat of latex primer; S-W DTM Acrylic Primer/Finish B66W1
   2. Semi-gloss: Two coats of latex enamel; S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series

D. Ferrous Metals, Primed, Latex, 2 Coat:
   1. Touch-up with latex primer; S-W DTM Acrylic Primer/Finish B66W1
   2. Semi-gloss: Two coats of latex enamel; S-W Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series

E. Masonry, Epoxy Enamel, 3 Coat (Semi-Gloss Finish):
   1. 1st Coat: S-W Heavy Duty Block Filler, B42W46 (10 mils wet)
   2. 2nd Coat: S-W Pro Industrial WB Catalyzed Epoxy B73-300 Series
   3. 3rd Coat: S-W Pro Industrial WB Catalyzed Epoxy B73-300 Series (4-8 mils dry per coat)

F. Gypsum Board, Latex, 3 Coat:
   1. Low Odor - Zero VOC, anti-microbial, silica-free primer Coating:
      a. S-W ProMar 200 Interior Latex Primer, (4 mils wet, 1.3 mils dry per coat)
   2. Low Odor (Eggshell) - Zero VOC, anti-microbial, silica-free Finish Coating:
      a. 2nd Coat: S-W ProMar 200 Interior Latex Eg-Shel, B20-2600 Series
      b. 3rd Coat: S-W ProMar 200 Interior Latex Eg-Shel, B20-2600 Series (4 mils wet, 1.6 mils dry per coat
   3. Low Odor (Flat) – Zero VOC, anti-microbial, silica-free Finish Coating:
      a. 2nd Coat: S-W ProMar 200 Interior Latex Flat, B20-2600 Series
      b. 3rd Coat: S-W ProMar 200 Interior Latex Flat, B20-2600 Series (4 mils wet, 1.6 mils dry per coat)

G. Gypsum Board, Epoxy Finish, 3 Coat:
   1. One coat of primer sealer; S-W ProMar 200 Zero VOC Interior Latex Primer, B28W2600
   2. Two coats of epoxy semi-gloss coating; S-W Pro Industrial Waterbased Catalyzed Epoxy Eg-Shel, B73-360

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. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. 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. Gypsum Wallboard: 12 percent.
   2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

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 mask 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. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

F. 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 and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

G. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

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. 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 in thicknesses specified by manufacturer.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

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

SECTION 10 11 00

VISUAL DISPLAY SURFACES

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. This Section includes the following:
   1. Markerboards.
   2. Tackboards.
   3. Display rails.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Show location of panel joints.
   2. Include sections of typical trim members.

C. Samples for Verification: For each type of visual display surface indicated and as follows:
   1. Visual Display Surface: Not less than 8-1/2 by 11 inches (215 by 280 mm), mounted on substrate indicated for final Work. Include one panel for each type, color, and texture required.
   2. Trim: 6 inch (152 mm) long sections of each trim profile.
   3. Accessories: Full-size Sample of each type of accessory.

D. Maintenance Data: For visual display surfaces to include in maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of visual display surface through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display surfaces and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-built visual display boards, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

B. Store visual display units vertically with packing materials between each unit.

1.06 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating visual display surfaces without field measurements. Coordinate wall construction to ensure that actual dimensions correspond to established dimensions.
2. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.07 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Surfaces lose original writing and erasing qualities.
      b. Surfaces become slick or shiny.
      c. Surfaces exhibit crazing, cracking, or flaking.
   2. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Product: Subject to compliance with requirements, provide product specified.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: ASTM A 424, enameling-grade steel, uncoated thickness indicated; with exposed face and edges coated with primer, 1.7 to 2.5 mil (0.043 to 0.064 mm) thick ground coat, and color cover coat; and concealed face coated with primer and 1.7 to 2.5 mil (0.043 to 0.064 mm) thick ground coat.
   1. Gloss-Finish Cover Coat: Gloss as indicated; dry-erase markers wipe clean with dry cloth or standard eraser. Minimum 3.0 to 4.0 mil (0.076 to 0.102 mm) thick cover coat. Cover and ground coats shall be fused to steel at manufacturer's standard firing temperatures but not less than 1475 deg F (802 deg C).
      a. Product: Connect Frameless Porcelain Markerboard.

B. Plastic-Impregnated Cork Sheet: MS MIL-C-15116-C, Type I, seamless, homogeneous, self-sealing sheet consisting of granulated cork, linseed oil, resin binders, and dry pigments that are mixed and calendared onto burlap backing; with washable vinyl finish and integral color throughout.

C. Mounting Assembly: Invisi-Mount by Claridge.

2.03 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboard Assembly: Balanced, high-pressure, factory-laminated markerboard assembly of 3-ply construction consisting of backing sheet, core material, and 0.021 inch thick (0.53 mm thick), porcelain-enamel face sheet with high-gloss finish.
   1. Manufacturers:
      a. Best-Rite Manufacturing.
      b. Claridge Products & Equipment, Inc.; Connect Frameless Porcelain Markerboard (Basis of Design)
      c. Ghent Manufacturing Inc.
      d. PolyVision Corporation.
   2. Hardboard Core: 1/4 inch (6 mm) thick; with 0.005 inch thick, aluminum foil (0.127 mm thick, aluminum foil) backing.

2.04 TACK ASSEMBLIES

A. Manufacturers:
   1. Best-Rite Manufacturing.
   2. Claridge Products & Equipment, Inc.
   3. Ghent Manufacturing Inc.
   4. PolyVision Corporation.
   5. Homosote.

B. Vinyl-Fabric-Faced Tack Assembly: 7/16 inch (11 mm) thick, vinyl-fabric-faced cork sheet factory laminated to 1/4 inch (6 mm) thick hardboard backing.

C. Recycled Wood Fiber Tack Assembly: 3/8 inch thick; .9 lbs/sq. ft.

2.05 VISUAL DISPLAY RAILS

A. Available Manufacturers:
   1. Best-Rite Manufacturing.
   2. Claridge Products & Equipment, Inc.
   3. Ghent Manufacturing Inc.
   4. Marsh Industries, Inc.
   5. PolyVision Corporation.

B. General: Manufacturer's standard, tackable visual display surface fabricated into narrow rail shape and designed for displaying material.

2.06 MARKERBOARD ACCESSORIES

A. Rail: Provide the following accessories:
   1. Display Rail: 79 Hang-Tight Rail System manufactured by Claridge or other specified manufacturers.
      a. Rail shall combine standard aluminum map and display rail with a specially designed extrusion that holds posters, pamphlets, blueprints, etc., securely in place without tacking.
      b. Tackable insert is approximately 1-5/8 inches wide. Material and color shall be as selected by the Architect.
   2. Display Rail: Continuous and integral with map rail; fabricated from cork approximately 1 to 2 inches (25 to 50 mm) wide.

2.07 FABRICATION

A. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
   1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
   2. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine walls and partitions for proper backing for visual display surfaces.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove dirt, scaling paint, projections, and depressions that will affect smooth, finished surfaces of visual display boards.

B. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, and substances that will impair bond between visual display boards and surfaces.

C. Prepare recesses for sliding visual display units as required by type and size of unit.

3.03 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.04 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY UNITS

A. Deliver completely assembled in one piece, wherever possible.

B. Follow manufacturer's instructions for storage and handling of units before installation.

C. Install level and plumb, in accordance with manufacturer's recommendations.

D. Visual Display Boards: Provide Invisi-Mount assembly by Claridge or approved equal.

E. Display Rails: Install rails in locations and at mounting heights indicated on Drawings, or if not indicated, at height indicated below. Attach to wall surface with fasteners at not more than 16 inches (400 mm) o.c.
   1. Mounting Height: 60 inches (1524 mm) above finished floor to top of rail.

3.05 ADJUST AND CLEAN

A. Verify that all accessories are installed as required for each unit.

B. At completion of work, clean glass surfaces, back panels and trim in accordance with manufacturer's recommendations, leaving all materials ready for use.

C. Touch up factory-applied finishes to restore damaged or soiled areas.

D. Cover and protect visual display surfaces after installation and cleaning.

3.06 VISUAL DISPLAY SURFACE SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Panel signs.

B. Dimensional letters and numbers.

C. Cast metal plaques.

1.02 SUBMITTALS

A. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles and finishes.

B. Shop drawings showing fabrication and erection of signs, include plans, elevations, and large-scale sections of typical members and other components. show anchors, grounds, layout, reinforcement, accessories and installation details
   1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
   2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.
   3. Templates: Furnish full-size spacing templates for individually mounted dimensional letters and numbers.
   4. Furnish full-size rubbings for metal plaques.

C. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
   1. Samples for initial selection of color, pattern, and texture.
      a. Cast Acrylic Sheet and Plastic Laminate: Manufacturer's color charts consisting of a actual sections of material including the full range of colors available for each material required.
      b. Aluminum: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4-inch squares of sheet or plate, showing the full range of colors available.

1.03 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

D. Regulatory Requirements: Comply with requirements of NFPA 101 and ANSI N2.1 for graphic symbols, colors, and printed information for panel signs.
   1. Comply with requirements of applicable Building Code, most recent edition.
   2. Comply with requirements of ANSI A117.1

1.04 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject t to compliance with requirement, provide products by one of the following comparable to the basis of design product indicated:
   1. Manufacturers of Panel Signs:
      a. Mohawk Sign Systems (Basis of Design).
      b. APCO Graphics, Inc.
      c. Andco Industries Corp.
      d. ASI Sign Systems, Inc.
   2. Manufacturers of Dimensional Letters:
      a. Mohawk Sign Systems (Basis of Design).
      b. Andco Industries Corp
      c. ASI Sign Systems, Inc.
   3. Manufacturers of Cast Plaques:
      a. Mohawk Sign Systems (Basis of Design).
      b. Andco Industries Corp.
      c. ASI Sign Systems.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Cast Acrylic Sheet: Provide cast (not extruded or continuous cast) methyl methacrylate monomer plastic sheet, with a minimum flexural strength of 16,000 psi when tested according to ASTM D 790, with a minimum allowable continuous service temperature of 176 deg. G, and the following general types:
   1. Transparent Sheet: Where sheet material is indicated as "clear", provide colorless sheet in matte finish, with light transmittance of 92 percent, when tested according to the requirements of ASTM D 1003.
   2. Opaque Sheet: Where sheet material is indicated as "opaque", provide colored opaque acrylic sheet in colors and finishes as selected from the manufacturer's standards.

B. Aluminum Sheet: Provide aluminum sheet of alloy and temper recommended by the sign manufacturer for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 209 for 5005-H15.

C. Aluminum Castings: Provide aluminum castings of alloy and temper recommended by the sign manufacturer for the casting process used and for the use and finish indicated.

D. Fasteners: Use concealed fasteners fabricated from the metals that not corrosive to the sign material and mounting surface.

E. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installation and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

F. Colored Coatings for Acrylic Plastic Sheet: Use colored coatings, including inks and paints for copy and background colors, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are nonfading for the application intended.

2.03 PANEL SIGNS

A. Panel Signs: Comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction.
   1. Produce smooth, even, level sign panel surfaces, constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally.
   2. Material: Acrylic plastic.
   3. Corner Condition: Square corners.

B. Subsurface Copy: Apply copy to the back face of clear acrylic sheet forming the panel face by process indicated to product precisely formed opaque images free from rough edges.
   1. Use reverse silk-screen process to print copy; overspray the copy with an opaque background color coating.
   2. Use Dupont Chromalin heat-and-pressure-laminated photopolymer film system to form copy and background color
      a. The manufacturer has the option of selecting either process indicated above.
   3. No raised applied letters or graphics allowed.

2.04 OCCUPANCY SIGNS

A. Provide two (2) each occupancy signs:
   1. Size: 8 x 12 inches.
   2. Text: Maximum occupancy load TBD number of persons.
   3. Character: Helvetica, 1 inch high.
   4. Type: Unframed panel sign.
   5. Copy: Raised surface.

2.05 MISCELLAENOUS SIGNS

A. Stairs.

B. Accessible Ramp.

2.06 DIMENSIONAL LETTERS AND NUMBERS

A. Cutout Letters and Numbers: Cut letters and numbers from solid plate material of thickness indicated. Produce precisely cut characters with square cut, smooth edges. Comply with requirements indicated for finish, style, and size.
   1. Metal: Aluminum.
   2. Letter Height: 8 inches.
   3. Letter Style: As selected by Architect from manufacturer's available fonts.

2.07 CAST METAL PLAQUES

A. Plaques: Castings shall be free from pits, scale, sand holes, or other defects. Comply with requirements specified for metal, border style, background texture, and finish wand with requirements shown for thickness, size, shape and copy. Hand-tool and buff borders and raised copy to produce the manufacturer's standard satin polished finish. Refer to the "Finishes" Article for other finish requirements.
   1. Metal: Aluminum.
   2. Size: 24 x 36 inches.
   3. Border Style: Plain bevel.
   4. Background Texture: Manufacturer's standard pebble texture.
   5. Background Finish: Clear anodized.
   6. Letter Style: As selected by Architect from manufacturer's available fonts.

2.08 FINISHES

A. Colors and Surface Textures: For exposed sign material that requires selection of materials with integral or applied colors, surface textures or other characteristics related to appearance, provide color matches indicated, or if not indicated, as selected by the Architect from the manufacturer's standards.

B. Metal Finishes: Comply with NAAMM "Metal Finishes Manual" for finish designations and applications recommendations.

C. Aluminum Finishes: Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
   1. Class II Clear Anodized Fine Satin Finish: AA-M31C21A31 (Mechanical Finish: Fine satin directional textured; Chemical Finish: Fine matte etched finish; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.02 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
   1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
   2. Install signs at height indicated below, measured from the finish floor to centerline of sign panel:
      a. Elementary Schools: 48 inches.
   3. Locate panel signs spaced 6 inches from frame of door, or latch side of door, unless otherwise indicated.

B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
   1. Silicone-Adhesive Mounting: Use liquid silicone adhesive recommended by the sign manufacturer to attach sign units to irregular, porous, or vinyl-covered surfaces. Use double-sided vinyl tape where recommended by the sign manufacturer to hold the sign in place until the adhesive has fully cured.

C. Dimensional Letters and Numbers: Mount letters and numbers using standard fastening methods recommended by the manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
   1. Projected Mounting: Mount letters at the projection distance from the wall surface indicated.

D. Caste Metal Plaques: Mount plaques using the standard method recommended by the manufacturer for the type of wall surface indicated.
   1. Concealed Mounting: Mount the plaques by inserting threaded studs into tapped lugs on the back of the plaque. Set in predrilled holes filled with quick-setting cement.

E. Protect from damage until Substantial Completion; repair or replace damaged items.

3.03 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.04 INTERIOR PANEL SIGN SCHEDULE

A. Interior Panel Sign: Classroom Sign.
   1. Unit Size: 8 x 8 inch.
   2. Permanent raised copy band: Classroom number & braille.
   3. Insertable subsurface for teacher name, image.

B. Interior Panel Sign: Room Identification Sign.
   1. Unit Size: 8 x 8 inch.
   2. Permanent raised copy band: Room number & braille.

C. Interior Panel Sign: Restroom Identification Sign.
   1. Unit Size: 6 x 8 inch.
   2. Permanent raised copy and pictogram: ANSI N2.1.

3.05 INTERIOR PANEL SIGN COPY SCHEDULE

A. See door and signage schedule on the Drawings.

END OF SECTION

SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 10 28 00 - Toilet and Bath Accessories.

1.03 REFERENCE STANDARDS

A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

1.04 SUBMITTALS

A. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall and floor supports, door swings.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Ampco Products, Inc: www.ampco.com.
   2. Bobrick: www.bobrick.com. (Basis of Design)
   3. Metpar Corp: www.metpar.com.
   4. Partition Systems International of South Carolina: www.psisc.com.
   5. Scranton Products (Santana/Comtec/Capital): www.scrantonproducts.com.
   6. Hadrian: www.hadrian-inc.com.
   7. Substitutions: Section 01 60 00 - Product Requirements.

2.02 SOLID PLASTIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance wtih NFPA 286, ceiling-hung.
   1. Color: See Finish Legend.

B. Doors:
   1. Thickness: 1 inch (25 mm).
   2. Width: 24 inch (610 mm).
   3. Width for Handicapped Use: 36 inch (915 mm), out-swinging.
   4. Height: 55 inch (1397 mm).

C. Panels:
   1. Thickness: 1 inch (25 mm).
   2. Height: 55 inch (1397 mm).
   3. Depth: As indicated on drawings.

D. Pilasters:
   1. Thickness: 1 inch (25 mm).
   2. Width: As required to fit space; minimum 3 inch (76 mm).

E. Compartment and Urinal Screens: Without doors; to match compartments; mounted to wall with continuous panel brackets.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed chromed steel with satin finish, 3 inch (76 mm) high, concealing floor fastenings.

B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch (25 mm by 38 mm) size, with anti-grip profile and cast socket wall brackets.

C. Pilaster Brackets: Polished stainless steel.

D. Wall Brackets for Partitions and Urinal Screen: Continuous type, satin stainless steel.

E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

F. Hardware: Polished 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 with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for out-swinging 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 (9 mm to 13 mm) 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 (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

END OF SECTION

SECTION 10 21 23

CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Suspended overhead metal curtain track and guides.

B. Curtains.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking and supports for track.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for curtain fabric characteristics.

C. Samples: Submit 12 by 12 inch (300 by 300 mm) sample patch of curtain cloth with representative top, bottom, and edge hem stitch detail, heading with reinforcement, bottom weight, and carrier attachment to curtain header.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Carriers: Ten.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept curtain materials on site and inspect for damage.

B. Store curtain materials on site and deliver to Owner for installation when requested.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Cubicle Track and Curtains:
   1. A. R. Nelson Co: www.arnelson.com/#sle.
   2. C/S General Cubicle: www.c-sgroup.com/cubicle-track-curtains/#sle.
   3. Imperial Fastener Co., Inc: www.imperialfastener.com/#sle.
   4. Inpro: www.inprocorp.com/#sle.

2.02 TRACKS AND TRACK COMPONENTS

A. Track: Extruded aluminum sections; one piece per cubicle track run; I-beam profile.
   1. Structural Performance: Capable of supporting vertical test load of 50 lbs (23 kg) without visible deflection of track or damage to supports, safely supporting moving loads, and sufficiently rigid to resist visible deflection and without permanent set.
   2. Track End Stop: To fit track section.
   3. Suspension Rods: Tubular Aluminum sections, sized to support design loads and designed to receive attachment from track and ceiling support.
   4. Escutcheons to Suspension Rods: Aluminum.
   5. Finish on Exposed Surfaces: Clear anodized finish.

B. Curtain Carriers: Nylon slider to accurately fit track; designed to eliminate bind when curtain is pulled; fitted to curtain to prevent accidental curtain removal; 2 carriers per foot (0.61 per meter) of track length.

C. Wand: Plastic hollow section, attached to lead carrier, for pull-to-close action.

2.03 CURTAINS

A. Curtain Materials:
   1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
   2. Open Mesh Cloth: Open weave to permit air circulation; flameproof material, same color as curtain.
   3. Products: See Finish Schedule.

B. Curtain Fabrication:
   1. Include open mesh cloth at top 18 inches (0.46 mm) of curtain for room air circulation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and supports above ceiling are ready to receive work of this Section.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install curtain track to be secure, rigid, and true to ceiling line.

B. See Section 06 10 00 for track supports above ceiling.

C. Install end cap and stop device.

D. Suspend track from ceiling system.

E. Install curtains on carriers ensuring smooth operation.

END OF SECTION

SECTION 10 26 00

WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Corner guards.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
   2. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
   3. Uniform and concentrated loads need not be assumed to act concurrently.

1.03 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
   1. Wall and Corner Guards: 12 inches (300 mm) long. Include examples of joinery, corners, end caps, top caps, and field splices.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.05 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of plastic and other materials beyond normal use.
   2. Warranty Period: Five years from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless-Steel Sheet: ASTM A 240/A 240M.

B. Fasteners: Nonmagnetic stainless-steel. Use security-type fasteners where exposed to view.

2.02 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      a. Construction Specialties, Inc.
      b. InPro Corporation (IPC).
      c. Korogard Wall Protection Systems; a division of RJF International Corporation.
      d. Pawling Corporation.
   2. Material: Stainless-steel sheet, Type 304.
      a. Thickness: Minimum 0.0625 inch (1.6 mm) 0.0781 inch (2.0 mm).
      b. Finish: Directional satin, No. 4.

2.03 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION

A. General: Install wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
   1. Install wall protection units in locations and at mounting heights indicated on Drawings.
   2. Provide other accessories required for a complete installation.
      a. Provide anchoring devices to withstand imposed loads.

END OF SECTION

SECTION 10 28 00

TOILET AND BATH 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. This Section includes the following:
   1. Public-use washroom accessories.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
   1. Construction details and dimensions.
   2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Material and finish descriptions.
   4. Features that will be included for Project.
   5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify products using designations indicated on Drawings.

C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

1.05 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.06 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312 inch (0.8 mm) minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359 inch (0.9 mm) minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

2.02 PUBLIC-USE WASHROOM ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products manufactured by Bobrick as indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
   1. A & J Washroom Accessories, Inc.
   2. American Specialties, Inc.
   3. Bradley Corporation.
   4. General Accessory Manufacturing Co. (GAMCO).

2.03 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.02 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

3.03 TOILET ACCESSORY SCHEDULE - SEE DRAWINGS

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION

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. This Section includes the following:
   1. Portable fire extinguishers.
   2. Fire-protection cabinets for the following:
      a. Portable fire extinguishers.
   3. Mounting brackets for fire extinguishers.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection cabinets.
   1. Fire Extinguishers: Include rating and classification.

B. Samples for Verification: For each type of exposed factory-applied color finish required for fire-protection cabinets, prepared on samples of size indicated below.
   1. Size: 6 by 6 inches (150 by 150 mm) square.

C. Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.05 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

2.03 PORTABLE FIRE EXTINGUISHERS

A. Manufacturers:
   1. Buckeye Fire Equipment Company.
   2. JL Industries, Inc.
   3. Kidde Fyrnetics.
   4. Larsen's Manufacturing Company. (Basis of Design)
   5. Potter Roemer; Div. of Smith Industries, Inc.

B. General: Provide fire extinguishers of type, size, and capacity for each mounting bracket indicated.
   1. Handles and Levers: Manufacturer's standard.
   2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

C. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10 lb (4-A:60-B:C, 4.5 kg) nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.04 FIRE-PROTECTION CABINET

A. Basis-of-Design Product: Model No. 2409-6R manufactured by Larsen's Manufacturing Company or a comparable product by one of the following:
   1. General Accessory Mfg. Co.
   2. JL Industries, Inc.
   3. Kidde Fyrnetics.
   4. Larsen's Manufacturing Company.
   5. Potter Roemer; Div. of Smith Industries, Inc.

B. Cabinet Type: Suitable for fire extinguisher.

C. Cabinet Construction: Non-rated and fire-rated as required.

D. Cabinet Material: Enameled-steel sheet.

E. Semi-recessed Cabinet: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
   1. Rolled-Edge Trim: 2-1/2 inch (64 mm) backbend depth.

F. Cabinet Trim Material: Steel sheet.

G. Door Material: Steel sheet.

H. Door Style: Solid opaque panel with frame.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide projecting door pull and friction latch.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
1) Location: Applied to cabinet door.
2) Application Process: Pressure-sensitive vinyl letters.
3) Lettering Color: Red.
4) Orientation: Vertical.

K. Finishes:
1. Manufacturer's standard primed paint for the following:
a. Exterior of cabinet, door, and trim, except for those surfaces indicated to receive another finish.
b. Interior of cabinet and door.

2.05 MOUNTING BRACKETS

A. Available Manufacturers:
1. JL Industries, Inc.
2. Larsen's Manufacturing Company.
3. Potter Roemer; Div. of Smith Industries, Inc.

B. Mounting Brackets: Manufacturer's standard chromed steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with chrome plated finish.

2.06 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
1. Weld joints and grind smooth.
2. Construct fire-rated cabinets with double walls fabricated from 0.0428 inch (1.1 mm) thick, cold-rolled steel sheet lined with minimum 5/8 inch (16 mm) thick, fire-barrier material.
a. Provide factory-drilled mounting holes.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.03 INSTALLATION

A. General: Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights indicated below:
   1. Fire-Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.
   2. Mounting Brackets: 54 inches (1372 mm) above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
   1. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

3.04 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection specialties are installed, unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet manufacturer.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 51 26

PLASTIC LOCKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Plastic lockers.

B. Locker benches.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

D. Samples: Submit two samples 6 by 6 inches (152 by 152 mm) in size, of color scheduled.

E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Plastic Lockers:
   1. Bradley; Lenox Cubby Lockers: www.bradleycorp.com..
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOCKER APPLICATIONS

A. Cubby Lockers: Six tier lockers, recessed mounted.
   1. Width: 18 inches (450 mm).
   2. Depth: 18 inches (450 mm).
   3. Height: 72 inches (1,830 mm).

2.03 PLASTIC LOCKERS

A. Frames: Constructed of 1/2 inch thick High Density Polyethylene (HDPe) with homogeneous color and a matte finish texture. Dirt of graffiti are easily removed with standard industrial cleaners. Frames are welded to cubby box to provide a secure, rigid assembly. Frame width is 1-7/8 inches on each side. Frame divider height is 1 inch.

B. Sides, Top, Bottoms and Dividers: Constructed of 3/8 inch thick white HDPE with a smooth finish. Sides and back of box are formed from a single sheet of HDPE with fused corners. Tops, bottoms and dividers are welded to box to form a complete uni without metal fasteners or dovetail joints.

C. Slope Top: Constructed of a 1 inch thick HDPE backplate (color may vary) and a 1/2 inch colored HDPE slope top panel. Back plate shall be secured to wall first, then panel shall be secured through the cubby locker op from the inside, no exposed fasteners.

D. Base: Constructed of 1 inch thick HDPE wit homogeneous color and a matte finish texture. Base height shall be as indicated or as directed by the Architect.

E. End Panels and Fillers: Manufacturer's standard, provided as required.

2.04 LOCKER BENCHES

A. Free-Standing Locker Room Bench: Maple top bench with aluminum trapezoid legs. Bench length shall be as indicated on the Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Place and secure on prepared base.

D. Install end panels, filler panels, and sloped tops.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

SECTION 10 73 00

ALUMINUM WALKWAY COVERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Design, fabrication, and installation of welded extruded aluminum walkway cover systems.

B. Products Furnished but not Installed Under this Section: Column sleeves (styrofoam blockouts) or anchor bolts (if required)

1.02 REFERENCES

A. The Aluminum Association (AA):
   1. The Aluminum Design Manual 2000, Specifications & Guidelines for Aluminum Structures.

B. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611, Voluntary Specification for Anodized Architectural Aluminum.
   2. AAMA 2603, Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
   3. AAMA 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.

C. American Society of Civil Engineers (ASCE):
   1. ASCE 7, Minimum Design Loads for Buildings and Other Structures.

D. American Society for Testing and Materials (ASTM):
   1. ASTM B 209, Specification for Aluminum and Aluminum- Alloy Sheet and Plate.
   2. ASTM B 221, Specification for Aluminum and Aluminum- Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   3. ASTM C 150, Specification for Portland Cement.
   4. ASTM C 404, Specification for Aggregates for Masonry Grout.

E. American Welding Society (AWS):
   1. ANSI/AWS D1.2, Structural Welding Code - Aluminum.

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Design Walkways in accordance with The Aluminum Design Manual 2000.
   2. Comply with the wind requirements of ASCE 7.
   3. Provide an all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable.
   4. Provide expansion joints to accommodate temperature changes of 120 degrees F. Provide expansion joints with no metal to metal contact.

B. Performance Requirements:
   1. Grout: Compressive strength of 2000 psi, minimum.

1.04 SUBMITTALS

A. Product Data: Manufacturer’s product information, specifications, and installation instructions for walkway cover components and accessories.

B. Shop Drawings: Include plan dimensions, elevations, and details.

C. Samples:
   1. Selection: Manufacturer’s standard range of colors for the finishes selected.
   2. Verification: 2-inch-square samples of each finish selected on the substrate specified.

D. Design Data: Design calculations bearing the seal of a Registered Professional Engineer, licensed in North Carolina. Design calculations shall state that the walkway cover system design complies with the wind requirements of ASCE 7, the stability criteria of applicable building code, and all other governing criteria.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least ten years experience in the design, fabrication, and erection of extruded aluminum walkway cover systems.

B. Installer Qualifications: Have walkway covers installed by manufacturer, third party installation is not acceptable.

PART 2 - PRODUCT

2.01 MANUFACTURERS

A. The design is based on products fabricated by: Peachtree Protective Covers, Inc., 1477 Rosedale Drive, Hiram, GA 30141, 770-439-2120, fax 770-439-2122.
   1. Comparable products by the following manufacturers also will be acceptable:
      a. Eastern Metal Supply.
      b. Dittmer Architectural Aluminum.
      c. Avadek Walkway Cover Systems.
      d. Mapes Industries, Inc.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Aluminum Members: Extruded aluminum, ASTM B 221, 6063 alloy, T6 temper.

B. Fasteners: Aluminum, 18-8 stainless steel, or 300 series stainless steel.

C. Protective Coating for Aluminum Columns Embedded in Concrete: Clear acrylic.

D. Grout:
   1. Portland Cement: ASTM C 150, Type I.
   2. Sand: ASTM C 404.
   3. Water: Potable.

E. Gaskets: Dry seal santoprene pressure type.

F. Aluminum Flashing: ASTM B 209, Type 3003 H14, 0.040 inch, minimum.

2.03 MIXES

A. Grout: 1 part portland cement to 3 parts sand, add water to produce a pouring consistency.

2.04 FABRICATION

A. General:
   1. Shop Assembly: Assemble components in shop to greatest extent possible to minimize field assembly.
   2. Welding: In accordance with ANSI/AWS D1.2.
   3. Bent Construction: Factory assemble beams to columns to form one-piece rigid bents. Where used make welds smooth and uniform using an inert gas shielded arc. Perform suitable edge preparation to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints can be used if supported by engineering calculations and/or testing.
   4. Deck Construction: Fabricate from extruded modules that interlock in a self-flashing manner. Positively fasten interlocking joints creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Assemble deck with sufficient camber to offset dead load deflection.

B. Columns: Provide radius-cornered tubular extrusions with cutout and internal diverter for drainage where indicated. Circular downspout opening in column not acceptable.

C. Beams: Provide open-top tubular extrusion, top edges thickened for strength and designed to receive deck members in self-flashing manner.

D. Deck: Extruded self-flashing sections interlocking into a composite unit. Provide welded plate closures at deck ends.

E. Fascia: Manufacturer's standard shape. Provide fascia splices where continuous runs of fascia are jointed. Locate splices to be in line with bents and fasten in place on hidden or non-vertical surfaces.

F. Arches: For barrel vault protective covers, provide sharp-cornered tubular extrusions.

G. Factory Finishing: Finish designations prefixed by AA comply with system established by the AAMA for designating aluminum finishes.
   1. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.4 mils to 0.7 mils thick),complying with AAMA 611.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Verify that all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.02 ERECTION

A. Erect protective cover true to line, level, and plumb. Protect aluminum columns embedded in concrete with clear acrylic. Fill downspout columns with grout to the discharge level to prevent standing water. Install weep holes at top of concrete in non-draining columns to remove condensation.

B. Provide hairline miters and fitted joints.

3.03 CLEANING

A. Clean all protective cover components promptly after installation.

3.04 PROTECTION

A. Protect materials during and after installation.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.03 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric].

D. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

D. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles:
   1. American Flagpole: www.americanflagpole.com.
   2. Concord Industries, Inc: www.concordindustries.com.
   3. Pole-Tech Co., Inc: www.poletech.com.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001.
   1. Material: Aluminum.
   2. Design: Cone tapered.
   3. Mounting: Ground mounted type.
   4. Outside Tip Diameter: 4 inches (101.6 mm).
   5. Nominal Wall Thickness:.188 inches (4.77 mm).
   6. Nominal Height: 30 ft (9.1 m); measured from nominal ground elevation.
   7. Halyard: Interior type.

B. Performance Requirements:
   1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 90 miles/hr (145 km/hr) wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.03 POLE MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.04 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch (150 mm) diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Cleats: 9 inch (230 mm) size, aluminum with galvanized steel fastenings, two per halyard.

D. Halyard: 5/16 inch (8 mm) diameter stainless steel aircraft cable.

2.05 OPERATORS

A. Hand Crank: Removable type.

2.06 MOUNTING COMPONENTS

A. Foundation Tube Sleeve: AASHTO M 36M, corrugated 16 gage, 0.0598 inch (1.52 mm) steel, galvanized, depth of 36 inches (914 mm).

B. Pole Base Attachment: Flush; steel base with base cover.

C. Lightning Ground Cable: Copper No. 6 AWG, soft drawn.

2.07 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Aluminum: Mill finish.

C. Finial: Gold anodized finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole, base assembly, and fittings in accordance with manufacturer's instructions.

B. Electrically ground flagpole installation.

C. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch (25 mm).

3.05 ADJUSTING

A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 10 89 00

MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes miscellaneous specialties items including the following:
   1. Kiln.

B. Related Information:
   1. Division 23 exhaust fan and ductwork sections for exhaust fan system for kiln installation.
   2. Division 28 fire detection system section for heat detector requirement for kiln installation.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, operating characteristics, fittings, accessories, and finishes.

1.03 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For miscellaneous specialties items to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 KILN

A. Kiln: Electrical kiln with digital timer, downdraft ventilation with vent system consisting of flexible duct connection and air-cooled motor, lid lifter, touchpad controls, and 6 half-shelf kit. Cone 10, 2350 degrees.
   1. Capacity: 9.9 cu. ft.
   2. Dimensions: 34-inch diameter by 33 inches high.
   3. Kiln Electrical Requirements: 208VAC/1 phase/31.7A, 11000W; breaker size: 60A; NEMA receptacle configuration: 6-50.
   4. Vent Motor Requirements: Refer to Division 23 exhaust fan section.
   5. Manufacturer and Product: Skutt Ceramic Products, Inc., Portland OR, (503)774-6000, www.skutt.com, Model KM-1227-3 PK.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine substrates for suitability for installation of miscellaneous specialties. Do not proceed with installation until substrates and surroundings comply with manufacturer's written instructions.

3.02 INSTALLATION

A. General: Install miscellaneous specialties where shown and according to manufacturer's written instructions.

B. Adjust and clean miscellaneous specialties; leave in working condition, ready for use.

C. Instruct owner's personnel on use and maintenance of miscellaneous specialties.

END OF SECTION

SECTION 11 31 00

RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Microwave.
   2. Refrigerator.
   3. Washer and Dryer.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.03 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Field quality-control reports.

C. Sample warranties.

1.04 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.05 WARRANTY

A. Special Warranties: Manufacturer agrees to repair or replace residential appliances or components 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 MICROWAVE OVENS

A. Microwave Oven:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Amana; a division of Whirlpool Corporation.
      b. General Electric Company (GE Appliances). (Basis of Design)
      c. KitchenAid; a division of Whirlpool Corporation.
   2. Mounting: Countertop
   3. Capacity: 2.2 cu. ft.
   4. Microwave Power Rating: 1200 W.
   5. Material: Stainless steel.
   6. Model No. JES2251SJ by General Electric or equal.

2.02 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer: Two-door refrigerator/freezer with freezer on bottom and complying with AHAM HRF-1.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Amana; a division of Whirlpool Corporation.
      b. General Electric Company (GE Appliances). (Basis of Design)
      c. KitchenAid; a division of Whirlpool Corporation.
   2. Type: Freestanding.
   3. Storage Capacity: 23.8 Cu. Ft.

4. General Features:
    a. Dispenser in door for ice and cold water.
    b. Interior light in refrigeration compartment.
    c. Interior light in freezer compartment.
    d. Automatic icemaker and storage bin.
5. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
6. Model No. GFE24JSKSS by General Electric.

2.03 CLOTHES WASHERS AND DRYERS

A. Clothes Washer: Complying with AHAM HLW-1.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Amana; a division of Whirlpool Corporation.
    b. General Electric Company (GE Appliances). (Basis of Design)
    c. Whirlpool Corporation.
2. Type: Freestanding, front-loading unit.
3. Capacity: 4.5 Cu. Ft.
4. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
5. Water-Efficient Clothes Washer: Provide clothes washer with modified energy factor greater than or equal to 2.0 and water factor less than 5.5.
6. Appliance Finish: Enamel.
7. Model No. GFW430SSMWW by General Electric.

B. Clothes Dryer: Complying with AHAM HLD-1.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Amana; a division of Whirlpool Corporation.
    b. General Electric Company (GE Appliances). (Basis of Design)
    c. Whirlpool Corporation.
2. Type: Freestanding, frontloading, electric.
3. Capacity: 7.5 Cu. Ft.
4. Features:
    a. Interior drum light.
5. Appliance Finish: Enamel.
6. Model No. GFD43ESSMWW by General Electric.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

B. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

3.02 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 114000 - FOODSERVICE

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.

B. Mechanical: Refer to Division 23.

1. Roof mounted fans and connecting ductwork not shown as part of the kitchen equipment.
2. Final connections, including approved welded duct connections to hoods.

C. Electrical: Refer to Division 25, 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 starters and switches furnished as part of the food service equipment unless otherwise indicated on the drawings.

1.3 WORK INCLUDING 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. Inter-wiring of food service equipment between components within equipment, such as heating elements, switches, thermostats, motors, etc., complete with junction box or disconnect switch 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. Extend all indirect waste lines to nearest floor receptor. All such drain lines to be property sized and copper pipe with silver paint unless specified otherwise. ABS or PVC is not acceptable as water at or above 140^{o}F is discharged from sinks and dish washers in CMS kitchens Drain shall terminate with proper air gap above flood rim of floor receptor. Coordinate materials with Division 22.

D. Mechanical Work:

1. Provide stainless exposed ducts to ceiling for exhaust hoods and make final connections.

2. Provide stainless exposed ducts to ceiling for dish machine.

1.4 QUALITY ASSURANCE

1. 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.

2. Contractor must be able to show that he is now and for the past five years has been engaged in distribution and installation of equipment, such as required under this contract, as his principal business.

3. Contractor shall be a recognized distributor for items of equipment specified herein which are of other manufacture than his own.

4. Only Contractors who can meet the foregoing qualifications will be acceptable.

1.5 SUBMITTALS

A. Submit shop drawings as required by General Conditions.

B. All shop drawings and rough-in drawings shall be CAD drawn; hand drawings are not acceptable.

C. 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 sets 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.

D. Provide the following plans at 1/4” scale: A separate numbered equipment layout with equipment list; a separate fully dimensioned electrical rough-in plan, a separate drawing for fully dimensioned plumbing rough-in plan. Each drawing may show equipment shaded down 50%. Rough-in set shall include all required structural, 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, cooking hood center-lines, etc., for equipment.

E. Food Service Equipment Contractor must attend the pre-construction conference and the pre-construction conference for food service equipment installation. Food Service Equipment Contractor shall visit site to verify all rough-in and sleeve locations prior to installation of sub 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.

F. 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, ceiling exhaust grilles, etc.

G. Rough-in plans shall also include all required outlet services for equipment which is designated as ”new”, "future”, or ’reset”, even though such equipment may not be included in this contract.

H. 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.

I. 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.

G. 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.

H. 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.

I. 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. Proposals shall be based on brands, materials, and forms of construction specified unless prior to bid Architect approves as equal to that specified products of other manufacturers, which conform to requirements of plan and specifications, in writing.

B. Any equipment offered for approval as ”equal” to equipment specified must conform to space limitations of layout. Cost of any deviation from kind or location of mechanical service provided in layout due to furnishing of an approved equal will be the responsibility of Food Service Equipment Contractor, at no extra cost to Owner.

C. If no equals are approved in writing by Architect, prior to bid, the brands and materials specified must be furnished and no other. Substitutions will be permitted subsequent to award of contract only by specific change order issued by Architect.

1.6 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.

1.7 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. Items of food service equipment furnished shall conform to standards of National Sanitation Foundation, Ann Arbor, Michigan, and shall bear the N.S.F. seal.

C. Food service equipment shall be installed in accord with N.S.F. standards.

D. 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 Wealth, local health codes, etc.

E. 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.

F. Rulings and interpretations of enforcing agencies shall be considered part of regulations.

1.8 SOUTH CAROLINA ENVIRONMENTAL HEALTH SERVICES

A. All food service equipment shall be installed according to the "Equipment Installation Guidelines" available in the "Guidelines For The Design, Installation and Construction of Food Establishments in South Carolina", on its web site at: *www.scdhec.gov*.

B. Areas for student service such as the hot and cold food counters must be provided with food shields to protect all unwrapped food or drink from the direct line of the student's mouth to the unprotected food. Unprotected food or drink must be intercepted by glass or similar-type shields. The minimum standard for food shields, as recommended by NSF International, shall be followed.

C. Food service equipment must be NSF International listed, Underwriters Laboratories Inc. (UL) Classified for Sanitation or, if not NSF or UL listed/classified, be constructed to meet current NSF/ANSI standards, according to 15A NCAC 18A, 2600, Rule .2617 paragraph (d). All utensils and equipment, including cooler and freezer shelving units, must be commercial, durable and constructed on non-toxic and easily cleanable materials.

PART 2 – PRODUCTS

2.1 MANUFACTURED EQUIPMENT

1. Except as may be specified otherwise under individual item specifications in *"Part 4 - 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:

1. All items of standard equipment shall be that manufacturer's latest model at time of delivery.
2. Substitutions for manufactured equipment specified will be accorded consideration under terms set forth in "Substitutions - Standards".

FABRICATED EQUIPMENT

A. Work shall be done in an approved workmanlike manner, to complete satisfaction of Owner, by one of the following three manufacturers only: Select Stainless (Matthews, NC), Eagle (Clayton, DE), Titan Stainless (Pageland, SC), Atlanta Custom Fabricators (Douglasville, GA), or LowTemp Jonesboro, GA). NSF label and manufacturer's label – not distributor's label - must be on each item.

B. Stainless steel shall be U.S. standard gauges as called for, 18-8, Type 302, or 304 type, No. 4 finish.

C. 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.

D. Legs and cross rails shall be continuously welded, unless otherwise noted, and ground smooth.

E. Bottom of legs at floor shall be fitted with sanitary stainless steel bullet type foot, with not less than 2" adjustment.

F. 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.

G. Closed gussets shall be a 3" minimum diameter at top, continuously welded to frame members or to sink bottom.

H. 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; Standard-Keil Model 416-A; or approved equal. Where exposed, furnish wastes chromium plated.

I. Rolls shall be 1-1/2 diameter, except as detailed contrary, with bull-nose corners, ground and polished.

J. 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.

K. Metal taps shall be one-piece welded construction, unless specified otherwise reinforced on underside with stainless steel hat sections or channels welded in place. Cross bracing to be not more than 30” on centers.

L. Drawers to be 18 gauge stainless steel channel type housing and drawer cradle, both housing and cradle being reinforced and welded at comers, housing being secured to underside of table top, and both housing and cradle being sized for and fitted with 18 gauge 20” x 20” x 5” deep stainless steel drawer insert having coved corners. Drawer insert shall be easily removable from cradle without tools or having to remove entire drawer. Drawers to have stainless steel fronts. Provide with recessed flush type stainless steel pulls.

M. Support drawer on fabricated 14 gauge stainless steel interlocking channel supports with stainless steel ball-bearing wheels with molded nylon tire. Support slides shall be load rated at 150 lb. per pair. Slides to be Standard-Keil 1425 Series or equal.

N. Hardware shall be solid materials and except where unexposed or specified contrary of cast brass, chrome plated. Stampings are not acceptable. Identify all hardware with manufacturer’s name and number so that broken or worn parts may be ordered and replaced.

O. 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.

P. Ends of all fixtures, backsplashes, shelves, etc., shall be finished flush to walls or adjoining fixtures.

Q. Dishtables draintables, backsplashes and turned-up edges shall have radius bends in all horizontal and vertical corners, coved at intersections.

R. Rounded and coved corners or radius bends shall be 1/2” radius or longer.

S. Undersides of tops to be coated with heavy-bodied resinous material compounded for permanent, non-flaking adhesion to metal, 1/8” thick, applied after reinforcing members have been installed, drying without dirt-catching crevices.

T. Metal components, unless specified or noted otherwise, to be the following gauges:

1.	Counter and table tops	14 ga. Stainless Steel
2.	Wall shelves	16 ga. Stainless Steel
3.	Pipe leg fixed undershelves	16 ga, Stainless Steel
4.	Drawer fronts (single pan)	16 ga. Stainless Steel
5.	Sinks and drainboards	14 ga. Stainless Steel
6.	Exhaust hoods	18 ga. Stainless Steel
7.	Dish Machine Vapor Duct	18 ga. Stainless Steel
8.	Legs (1 - 5/8 diameter)	16 ga. Stainless Steel
9.	Trayslides	14 ga. Stainless Steel

U. All undershelves are fixed, non-removable.

V. All casters to be 5” diameter, swivel, stainless steel, with locks.

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 or starter 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 approved in writing by Architect. Provide master keys.

2.7 LAMINATED PLASTIC

A. Wherever laminated plastic materials are specified, they shall be Formica, Packwood, Micarta, or approved equal.

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.

2.9 INDIRECTE WASTE

A. Indirect wastes from cooking equipment and sinks are to be copper, provided and installed by Division 23.

B. Walk-in cooler & freezer evaporator coil drain lines are to be cooper, provided and installed by Division 114000.

PART 3 - EXECUTION

3.1 GENERAL

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 herein before 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 arrangement 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 Contractor s 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 wall 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 Dow Corning # 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) by covering horizontal surfaces with powdered borax at a rate of 4 oz. per square foot.

3.4 TESTING AND DEMONSTRATION OF EQUIPMENT

A. After completion of installation, all equipment requiring the use of water, gas, and electricity shall be performance inspected and tested by factory certified service agent. 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 stare 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, 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 one year from date of Substantial Completion all new equipment furnished. Five years warranty period on refrigeration compressors. Ten years warranty on walk-in refrigeration 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 loose-leaf 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

4.1 ITEM 1 QUANTITY AS SCHEDULED

A. Provide air curtain fan having the following features:

1. Type 304 stainless steel exterior with adjustable deflectors and adjustable air intake.
2. Electrical characteristics as scheduled.
3. Roller-type micro-switch or contacts for automatic door-actuated on-off control, to work with building door.

B. Air Curtain to be as manufactured by **Berner Model ASR1048A-SS**, Mars Model STD48-1U-SS or pre-approved equal.

4.2 ITEM 2 COLD STORAGE ASSEMBLY QUANTITY AS SCHEDULED

A. Provide pre-fabricated cold storage room assembly of size and shape shown on plan and detail drawings. Exact overall size to be field verified prior to fabrication.

B. Insulation:

1. Panels shall be insulated with 4” thick injected urethane, expanded with R1416, no CFC’s used Foam shall be 2.25-Ib. density, 95% closed cell. Panels shall meet ASTME-84 (UL-723) and be listed by Underwriters Laboratories and by Factory Mutual as a Class I building material.
2. All doors, wall, ceiling and floor panels shall comply with North Carolina Building Code Section 2603.4.1.3.

C. Coved corners:

1. Assembly shall be constructed so that all interior wall, floor and ceiling intersections shall have integral coved corners.

D. Cam lock fasteners:

1. All panel intersections and wall, floor and ceiling intersections shall be secured by cam lock fasteners.

E. Finishes:

1. Aluminum exterior and interior finishes shall be as shown on detail drawings. Stucco stainless is not acceptable.
2. Provide 48” high aluminum wainscot on all exposed exterior surfaces.

F. Doors

1. Door size and finish shall be as shown on drawings, and shall be furnished complete with sill wiper gasket, lift type hinges.
2. Hinges, latches and hardware shall be chrome plated.
3. Exterior door to be equipped with automatic door closer.
4. Freezer door to be equipped with perimeter heat.
5. Exterior door(s) to be equipped with cylinder lock having inside safety release feature.
6. Aluminum diamond kick plate 48” high to be provided on door exterior.

G. Thermometers:

1. Each compartment to be provided with exterior flush mounted thermometer mounted at eye level to each door.

H. Lights:

1. Lights: Each compartment to be furnished complete with Kason model 1806 LED light fixture, having protective cover, mounted and pre-wired to switch with pilot light in door section.
   a. Unbreakable lexan globe.
   b. Rated 50,000 hr. life.
   c. Exceeds Federal Energy Act requirement at 85 lumens/watt.
   d. Lamps to be cUL listed, NSF listed and RoHS compliant.
   e. Reach full light immediately at lowest temperatures.
   f. 5-yr. limited warranty on fixture.
   g. 3-yr. limited warranty on lamps.
2. Extra Kason model 1810 4-ft. LED lights as needed to provide 30 foot candles 30" above floor.
   a. Unbreakable IP-65 polycarbonate enclosure.
   b. Exceeds Federal Energy Act requirement at 67 lumens/watt.
   c. Rated 50,000 hr. life.
   d. 5-yr. limited warranty on fixture.
   e. 3-yr. limited warranty on lamps.
   f. Reach full light immediately at lowest temperatures.
   g. Lamps to be UL listed, NSF listed and RoHS compliant.

I. Floor:

1. Integral floor to be galvanized steel, to be covered with thickset quarry tile by G.C. (see Architectural plans & specifications).
2. The floor and ceiling shall have maximum length panels to span full length of box if possible, otherwise stagger joints so there are no common “four corner” intersections and no joints occurring in doorways.
3. The floor panels are to be not less than 4" thick.

J. Refrigeration System:

1. Shall be furnished by manufacturer as part of cold storage room assembly, provide each compartment with complete refrigeration system sized to maintain appropriate temperature.
2. Condensing units to be scroll-type only, air-cooled, remote. Units to have performance and wiring characteristics as scheduled on drawings. Units shall have pre-wired disconnects.
3. Condensing units to be provided with painted galvanized steel all-weather housing, controls, and crankcase heaters, all suitable for outdoor conditions, and located as shown on drawings.
4. Unit coolers to be low-silhouette type, mounted at locations shown on drawings. Performance and wiring characteristics to be as scheduled on drawings. Freezer system(s) to be provided with timed electric defrost.
5. Evaporator copper drain lines to be provided by this section and extended to floor receptors outside assembly. Drain lines are to be installed by the F.S.E.C.
6. Freezer copper drain lines to be wrapped with heater cable.
7. Refrigerant piping to be ACR copper tubing, hard temper, with wrought fittings and silver solder joints, Insulate suction lines with 1/2” pre-molded foamed plastic insulation.
8. Refrigeration systems to be provided with all required refrigerant piping, insulation, vibration eliminator solenoid(s), dryer, suction tine fitter, expansion valve(s), thermostat(s), heat exchangers, and defrost timers, etc. as necessary for complete installation. Provide pump down control circuit consisting of thermostat and solenoid valve. All components including piping and insulation to be installed using accepted industry standards, manufacturer’s instructions and first class workmanship.

K. Miscellaneous:

1. Provide l/8” diamond tread wainscot along exposed exterior of assembly walls and doors, mounted from floor to 48 A.F.F.
2. Provide trim strips, closure panels, etc., as necessary to trim assembly to adjacent building surfaces.
3. Provide removable top closure panels with ”C” channel rails. Lift-out panel sections to have turn- down edges for strength and are not to exceed 4’-0” in length.
4. Provide plastic strip curtains at door locations, transparent vinyl overlapping strips, aluminum bar hanging rod and bracket, suitable for low temperature application, as manufactured by Curtron, Flexstrip Products, Inc., or equal.
5. Provide heated pressure relief port in freezer.
6. Provide sleeves property located for utility entrance, drain lines, and refrigeration lines, and after lines are installed fill sleeves with caulking compound, suitable for use in refrigerated spaces.
7. Cold storage room shall be erected by factory trained and certified installers or shall be supervised by factory personnel. Refrigeration systems shall be furnished by cold storage room manufacturer and installed by factory authorized personnel.
8. F.S.E.C. to provide four-foot fluorescent light fixtures with bulbs.
9. All walk-in panel penetrations to be sealed by F.S.E.C.
10. Energy Star Certified.

L. This specification does not constitute a complete description of cold storage assembly, also see plan and detail drawings.

M. Cold storage room assembly to be as manufactured by Bally, Masterbilt, Kolpak, Norlake, or Thermokool modified to match the above specifications.

4.3 ITEM 3 SHELVING UNIT, COLD STORAGE QUANTITY AS SCHEDULED

A. Provide four-tier polymer shelving unit complete with tubular uprights and having the following features:

1. Uprights shall be nominal 74" high, numbered at one inch intervals.
2. Shelf connectors to be wedge lock type with corner collar.
3. Each unit to be free standing.
4. Shelf frames shall be made of steel with electroplated substrate and epoxy finish. Shelf mats to be injection molded polypropylene.
5. Arrange using quantities and sizes as shown on plan drawings.
6. 800 pound per shelf capacity, minimum.

B. Shelving to be as manufactured by **Metro Model Max Q**, Eagle Lifstor, or Amco Plastic Plus.

4.4 ITEM 4 DUNNAGE RACK QUANTITY AS SCHEDULED

A. Provide single deck dunnage platform unit with the following features:

1. One-piece polymer construction.
2. Slotted deck.
3. 21"/22" wide by 36"/48" long by 12" high.
4. Arrange as shown on plan drawings, using quantities and sizes as specified.

B. Dunnage rack to be as manufactured by Cambro Model DRS36/480131, Metro, Model HP2236/48PD or Eagle.

4.5 ITEM 5 SHELVING UNIT, DRY STORAGE QUANTITY AS SCHEDULED

A. Provide five-tier bright zinc plated wire shelving unit complete with tubular uprights and having the following features:

1. Electro-zinc plated with chromate bath and clear protective coating.
2. Uprights shall be nominal 86" high.
3. Adjustable feet.
4. Each unit to be free standing.
5. Arrange using quantities and sizes as shown on Plan Drawings.

B. Shelving to be as manufactured by **Metro Model BR Series**, Eagle or Amco.

4.6 ITEMS 6 CART, UTILITY, TWO-TIER QUANTITY AS SCHEDULED

A. Provide two-tier utility cart having the following features:

1. Frame-16 gauge, 1” square tubing.
2. 16 gauge reinforced, 21” X 33” stainless steel shelves.
3. All stainless steel construction.
4. Leg and handle bumpers.
5. 500 lb. Capacity per shelf
6. Two shelves.
7. 5” all swivel casters.

B. Cart to be as manufactured by **Choice Equipment Model UC20-3321-2**, Win-Holt Model UC-2-2133SS, Lakeside Model 543.

4.7 ITEM 7 UNIVERSAL PAN RACK QUANTITY AS SCHEDULED

A. Provide bun rack having the following features:
1. All-welded aluminum construction.
2. End loading.
3. No-tip 2” channels.
4. Designed for 18" x 26" pans and trays.
5. 350-lb. capacity.
6. 5” diameter swivel casters, all with brakes.
7. Lifetime guarantee against rust.

B. Mobile universal pan rack to be as manufactured by Choice Equipment PR10-A-1810, Lakeside 8900 or Win-Holt AL-1820/HD.

4.8 ITEM 8 HAND SINK QUANTITY AS SCHEDULED

A. Provide wall-mounted hand sink having the following features:

1. 10" x 12" x 6" bowl.
2. Gooseneck double pantry faucet with wrist handles.
3. Type 304 16 gauge stainless steel construction.
4. Basket drain.

B. Hand sink to be as manufactured by **Select Stainless Model SHS-1-SD,** LowTemp, Atlanta Stainless, or Titan Stainless.

4.9 ITEM 9 Hose Reel, 50-Ft. QUANTITY AS SCHEDULED

A. Provide open type retractable hose reel having the following features:

1. T&S Model B-7142 hose reel, stainless steel open reel.
2. Continuous pressure type vacuum breaker, T&S Model B-963.
3. Shut-off control, T&S Model B-ORK3.
4. Spray gun, Model MV-2516-24.
5. B-131 wall-mounted mixing faucet with spring check valves and ½" NPT inlets.
6. 50 feet long heavy-duty hose.
7. All chrome exposed interconnecting pipe.
8. HW-4B-36 flexible hose with 360° spin quick disconnect.
9. Adjustable hose bumper.
10. Model B-0166 brass hook.
11. Mount on wall at location shown on plan and detail drawings.
12. P.C. to provide and install inline check valves above ceiling.

B. Hose Reel to be as manufactured by **T&S Model B-7142-02**, Zurn or Fisher (Chicago Faucet is not acceptable).

4.10 ITEM 10 WORKTABLE QUANTITY AS SCHEDULED

A. This item to be custom fabricated in accord with General Requirements of specifications and with plan and detail drawings, and is to be constructed with 14-gauge stainless steel. Provide S/S drawer, S/S fixed under-shelf and four stainless steel legs with S/S adjustable feet. Table is to be 72" long per detail drawings.

B. Approved manufacturers: **Select Stainless** (Matthews, NC), LowTemp (Jonesboro, GA), Atlanta Stainless (Atlanta, GA) or Titan Stainless (Pageland, SC).

4.11 ITEM 11 UTILITY CHASE QUANTITY AS SCHEDULED

A. This item to be custom fabricated in accord with General Requirements of specifications and with plan and detail drawings.

B. Stainless steel chase to be 8" x 8", from top of low wall to 2" above ceiling.

C. Approved manufacturers: **Select Stainless** (Matthews, NC), LowTemp (Jonesboro, GA), Atlanta Stainless (Atlanta, GA) or Titan Stainless (Pageland, SC).

4.12-13 SPARE NUMBERS

4.14 ITEM 14 WARMING CABINET/PROOFER QUANTITY AS SCHEDULED

A. Provide mobile warming cabinet/proofer having the following features:

1. All stainless steel construction.
2. 20 Amp plug with 8' wire.
3. Universal Tray Slides to hold 14 bun pans or 28 steam table pans.
4. Maintains temperatures from 85º F to 180º F.
5. Circulating fan to maintain even temperature throughout cabinet, as well speed initial warm up and recovery times.
6. External thermometer.
7. Dutch doors.
8. Bottom mounted water pan.
9. 5" locking casters.
10. Full perimeter bumper.

B. Warming cabinet/proofer to be as manufactured by Winston Model HA4522, Wilder 7500-HH-UA13 or Pre-Approved Equal.

4.15 ITEM 15 WORKTABLE W/SINK QUANTITY AS SCHEDULED

A. This item to be custom fabricated in accord with General Requirements of specifications and with plan and detail drawings, and is to be constructed with 14-gauge stainless steel. Table is to include under-shelf , drawer and T&S B-0331 faucet.

B. Approved manufacturers: **Select Stainless** (Matthews, NC), LowTemp (Jonesboro, GA), Atlanta Fabricators (Atlanta, GA) or Titan Stainless (Pageland, SC).

4.16 ITEM 16 SLICER QUANTITY AS SCHEDULED

A. Provide food slicer having the following features:

1. Automatic operation, 13” diameter blade.
2. ½-HP motor wired for 120/1 operation, with cord and plug set.
3. Stainless steel removable knife.
4. Adjustable capacity: 12" wide or 7" diameter.
5. Adjustable gauge up to 1" thickness.
6. Two-speed automatic carriage drive.
7. Top mounted removable sharpener with mineral stone.
8. Zero knife exposure.
9. Removable ring guard cover.
10. Heavy-duty S/S knife cover.
11. All-metal finish.
12. Lift lever for easy cleaning.
13. MICROBAN antimicrobial protection.

B. Slicer to be as manufactured by **Hobart Model HS7-1**, Globe or pre-approved equal.

4.17-18 SPARE NUMBERS

4.19 ITEM 19 COOK'S TABLE W/POT RACK & SINK - QUANTITY AS SCHEDULED

A. This item to be custom fabricated in accord with General Requirements of specifications and with plan and detail drawings, and is to be constructed with 14-gauge stainless steel. Table is 8'-0" long and is to include under-shelf and drawer.

B. Approved manufacturers: **Select Stainless** (Matthews, NC), LowTemp (Jonesboro, GA), Atlanta Fabricators (Atlanta, GA) or Titan Stainless (Pageland, SC).

4.20 ITEM 20 EXHAUST HOOD QUANTITY AS SCHEDULED

Note: Items #20 & #22 must be provided by same manufacturer.

A. Provide double bank "eyebrow-style" island type canopy exhaust hood of size, shape and content as shown on detail drawings, having the following features:

1. All exposed surfaces of 18 gauge type 304 Series, 18-8 stainless steel construction.
2. N.F.P.A. 96 construction, including all joints and seams welded externally, continuous and liquid tight.
3. 5/8" diameter hanger rods to structural ceiling, approximately 48" on center.
4. Stainless steel baffle type U.L. classified grease extracting filters, with handles.
5. Integral grease gutter sloped to drain to grease receptacle.
6. Vapor-proof U.L. listed recessed fluorescent light fixtures.
7. Coordinated installation of fire control system as specified for Item 40.
8. Ventilation shall be compensating with the additions of perforated supply plenum (PSP). Supply air shall discharge thru panels at the bottom of the plenum. This supply plenum shall be located plenum on front perimeter as shown on plan and detail drawings.
9. Removable stainless steel perimeter trim and/or closure panels from top of hood to ceiling.
10. Food Service Equipment Contractor shall provide and install any secondary supporting member required to suspend exhaust hoods.
11. Hood supports shall include seismic bracing, if required, installed in accord with SMACNA guidelines.
12. Pre-wire fan control package.
13. Provide stainless steel cabinet on end of hood for fire control system, and pre-wire package. Switches to be remotely located in riser of item 118, utility chase.
14. Coordinate installation of Item 118, S/S Utility Distribution Chase.

B. Exhaust hood to be as manufactured by CaptiveAire Model ND-PSP, Avtec or Gaylord.

4.21 ITEM 21 FIRE CONTROL SYSTEM QUANTITY AS SCHEDULED

A. Provide automatic wet chemical fire control system as required to protect exhaust hood, Item 20, and the cooking equipment located under this hood, and having the following features:

1. All tanks, control heads, piping, relays, cable, fusible links, nozzles, elbows, etc., as required for complete system.
2. Brass nozzles and chrome plated or sleeved exposed piping.
3. Manual strike mechanism in accessible location.
4. Installation in accord with N.F.P.A, 17A code requirements and coordinate with exhaust hood construction and installation.
5. Four contacts for use by E.C., one contact for alarm, one for supply fan shut-off, one for shunt trip actuation, and one spare.
6. Install in 12" wide stainless steel fire cabinet attached to item #20, exhaust hood.
7. Provide mechanical gas solenoid valve loose for installation by plumber.

B. Fire control system to be as manufactured by **Ansul Model R-102**, Range Guard or Pyro Chem.

4.21A ITEM 21-A FIRE CONTROL PULL STATION QUANTITY AS SCHEDULED

A. Provide automatic wet chemical fire control system pull station as part of Item 21, fire control system.

4.22 ITEM 22 UTILITY DISTRIBUTION SYSTEM QUANTITY AS SCHEDULED

Note: Items 20 & #22 must be provided by same manufacturer.

A. Provide island utility chase to serve items under exhaust hood, having the following features:

1. Stainless steel construction.
2. UL label.
3. Each electric service to contain up to (4) conducting copper bars having a balanced load across them. Power from the main breaker feeds the Buss bar. The line side of the branch breakers is connected to the Buss bar and the load side to the appliance receptacle. Extra connection points are located along the Buss to allow relocation or addition of receptacles. Watertight electrical receptacles to match equipment. GCFI electrical receptacles required for attached equipment.
4. Emergency Kill Switch: Provide single point manual emergency shutdown of electrical power equipment. This will shut down all utilities and requires manual resetting.
5.
6. Fire/ Fuel Shutoff: In compliance with NFPA 96, terminal connection points provided for field wiring to the fire protection system micro switch to shut off fuel sources and power in the event of a fire.

7. Fire/ Fuel Shutoff: In compliance with NFPA 96, terminal connection points to be provided for field wiring to the fire protection system micro switch to shut off fuel sources and power in the event of a fire.
8. 3/4” minimum hot water and cold water manifold with tees and shut-off valves.
9. Gas and water quick disconnects and appropriate cord and plug sets as required by equipment for installation under Division 15 and 16. Hoses are to meet appropriate code requirements (UL, AGA, MA).
10. Length as shown on drawings, with utilities coming from above.
11. Mount switches for pre-starter and hood lights in end riser, approximately 48” above the finished floor.
12. Coordinate with submittal and installation of Item 37, Exhaust Hood.
13. Utility Housing: The raceway system includes risers, pedestals, and exterior panels and is constructed completely of 16-gauge stainless steel. All utility components are housed within this stainless steel enclosure.
14. Utility Raceway: Plumbing and electrical compartments are entirely enclosed and are accessible through removable panels.
15. Risers: Single point field connections are done in the vertical chases. These house the main electrical disconnect and plumbing manifold shut off valves, which are accessible through removable panels.
16. Pedestals: May be provided on multiple sections to support the weight of the system.
17. The Utility Distribution System (UDS) furnished for this job to be built in strict compliance with the National Electric Code and the National Sanitation Foundation Standards (NSF).

B. Utility distribution system to be as manufactured by **CaptiveAire Model UDI**, Avtec, or Gaylord.

4.23 ITEM 23 S/S FLOOR TROUGH ASSEMBLY QUANTITY AS SCHEDULED

A. Provide floor trough with removable grate having the following features:

1. Grate:

   a. All Stainless steel welded construction.
   b. 3/16” x 1” flat bars set on edge, with 13/16” clearance between bars.
   c. Two 1/2” diameter rods wedged through bars full length, and welded to each bar.
   d. Size to suit trough with removable sections not to exceed 20” long.

2. Trough

   a. 14-gauge 304 18-8 stainless steel, all welded with coved corners and anchor straps, full perimeter flange for installation under grout.
   b. Pitch to waste and provide stainless steel cup with removable perforated stainless steel basket.

c. Overall trough size to be approximately 2’-0” wide x 3’-0” long.
d. See plan for clarification. Coordinate with General Contractor and Plumbing Contractor to assure proper installation.

B. Floor Trough Assembly to be as manufactured by **IMC/Teddy Food Service Corp., Model FT2436-SG-SS**, Gates Manufacturing (St. Louis, MO), Select Stainless (Matthews, NC), LowTemp Jonesboro, GA), Titan Stainless, Atlanta Fabricators (Atlanta).

4.24 ITEM 24 TILT SKILLET, 30-GAL. QUANTITY AS SCHEDULED

A. Provide gas-fired tilt skillet having the following features:

1. 30-gallon capacity with capacity rating to bottom of pouring lip.
2. 120v/3ph electrical service, with cord & plug set.
3. Power tilt with hydraulic hand tilt option.
4. Natural gas operation suitable for this area; provide gas pressure regulator and shut-off.
5. Stainless steel clad 5/8" cooking surface guaranteed against warping.
6. Stainless steel coved cornered pan with gallon and liter markings.
7. All stainless steel construction.
8. Adjustable, electronic thermostat controls for temperatures from 100^{o}F to 425^{o}F.
9. Double pantry faucet model DPS14, including mounting bracket.
10. Spring assist cover with adjustable vent and full width handle.
11. Off/on switch, thermostat knob and pilots, recessed to avoid breakage.
12. Adjustable S/S flanged feet at rear, to be fastened to floor by FSEC in proper alignment with item 23, floor trough.
13. Spout at middle of pan.
14. Modular open base.
15. Serviceable from the front of unit.
16. Anti-splash pouring lip.
17. High limit safety device set at 450^{o}F.
18. UL, AGA and NSF approved.

B. 30-gallon tilt skillet to be as manufactured by Cleveland Model SGL30TR, Market Forge, Southbend or Groen.

4.25 SPARE NUMBER

4.26 ITEM 26 CONVECTION STEAMER QUANTITY AS SCHEDULED

A. Provide two-compartment pressureless steamer having the following features:

1. Two compartment pressureless floor model steamer.
2. Solid one- piece body for both compartments with heavy duty 14 gauge stainless steel construction for cooking compartments and doors.

3. Twin high efficiency power burner forced air generators rated at approximately 72,500 BTU's per compartment.
4. Total independent cooking compartments with separate gas valve, ignition and water level controls. No shared components between compartments.
5. Fan-less high velocity steam distribution system featuring brass steam jets.
6. Manual 60 minute electro-mechanical timers with load compensating feature and bypass switch for constant steaming.
7. Automatic water fill on start-up.
8. Drain/power control system with large manual ½" ball valve on control panel for generator blow-down.
9. Electronic spark ignition.
10. De-liming port.
11. Capacity for ten (10) 12" X 20" X 2 ½" pans.
12. Front access generator controls with pull-out drawer for simple servicing.
13. Water filtration system.
14. Manual 60-minute electro-mechanical timers with load compensating feature and bypass switch for constant steaming.
15. Reversible door gaskets.
16. Three year warranty for parts, labor and mileage.

B. Steamer to be as manufactured by **Cleveland Model 24-CGA-10.2**, Market Forge or pre-approved equal.

4.27 ITEM 27 CONVECTION OVEN, DOUBLE QUANTITY AS SCHEDULED

A. Provide gas-fired convection oven having the following features:

1. Two sections, standard depth, stacked.
2. Stainless steel front, sides and top; full metal rear cover.
3. Solid stainless steel doors.
4. Single porcelain door handle with simultaneous door operation.
5. Triple-mounted pressure lock door design with turnbuckle assembly.
6. Rear manifold connection with gas pressure regulator and manual shut-off.
7. 48" long quick disconnect gas hose.
8. Dual flow gas system.
9. Set of 6" high adjustable stainless steel legs.
10. Suitable for use with natural gas.
11. Cook/cool mode selector.
12. Control area cooling fan.
13. Separate solid state thermostat with infinite temperature control range of 200^{o}F to 500^{o}F.
14. 60 minute timer.
15. 1/3 HP blower motors permanently lubricated over blower motors and thermal overload protection.
16. Two commercial bake oven lamps per compartment.
17. Air mixers with adjustable air shutters.
18. Unit wired for 120-volt with cord and plug sets.

19. Porcelain interior liners with 14 gauge stainless steel door liners.
20. Electronic spark ignition.
21. Interior lights.
22. Five chrome-plated racks, eleven rack positions.
23. UL/ETL, AGA and NSF approved.
24. Five-year oven door warranty.
25. Energy Star Certified.
26. Replacement parts guaranteed available for 12 years from purchase date.

B. Convection oven to be as manufactured by **Blodgett Model DGF-100**, Southbend Model GB/25CHH, Imperial Model ICVDG-2 or Garland Model MCO-GS-10-ESS.

4.28 ITEM 28 OVEN/STEAMER COMBI, DOUBLE QUANTITY AS SCHEDULED

A. Provide two stacked gas-fired boilerless oven/steamers combination having the following features:

1. Natural gas; gas pressure regulator w/shut-off suited for this location.
2. Hard-wire electrical characteristics as scheduled with hard-wired connection.
3. Self-cooking cooking mode for roasts, grills, poultry, fish, side dishes, baked dishes and automatic finishing.
4. Combi-cooking mode for most cooking methods using steam and hot air, separately, sequentially, or combined.
5. Retherm function.
6. Minimum 6 slide rails per unit.
7. Microprocessor-controlled cooking process; touch pad controls.
8. Digital display.
9. Core temperature probe.
10. Fully automatic cleaning system.
11. Sensor-control cabinet humidity.
12. Core temperature control.
13. Water filter system.
14. Door handle with safety latch and slam function.
15. Data storage for HACCP and pasteurization figures.
16. Ethernet port.
17. Cleaning kits with shelves attached to the side opposite the door hinges.
18. Stacking kit.
19. S/S adjustable legs.
20. UL and NSF approved.

B. Combi to be as manufactured by **Rational Model CC62NG(B628206.19E)/SCC62NG(B628206.19E)**, Convotherm Model C4ET6.20GS/C4ET.6.20G or Alto-Sham Model CTC7-20G/CTC7-20G.

4.29 ITEM 29 REFRIGERATOR, REACH-IN QUANTITY AS SCHEDULED

A. Provide two-section reach-in refrigerator with top mounted air-cooled condensing unit, exterior dial thermometer, cylinder door locks and top mounted condensate evaporator, having the following features:
NOTE: Items 76, 77 and 103 must be provided by the same manufacturer.

1. Full-height stainless steel doors, hinged as shown on drawings.
2. Stainless steel exterior and stainless steel interior.
3. Six adjustable stainless steel wire shelves per compartment.
4. Set of 5” swivel type locking casters.
5. Wired for 120/1 operation, with card and plug set.
6. Top-mounted condensate evaporator.
7. Stainless steel back cover to hide condensing unit.
8. Energy Star Certified.

B. Refrigerator to be as manufactured by **Victory Model RS-2D-S1**, Traulsen Model RHT232WUT, Delfield Model GBSR2P-S or Continental Model DL2R-SS.

4.30 ITEM 30 THREE-COMPARTMENT SINK QUANTITY AS SCHEDULED

A. This item to be custom fabricated in accord with General Requirements of specifications and with plan and detail drawings.

B. Approved manufacturers: Select Stainless (Matthews, NC), LowTemp (Jonesboro, GA), Titan Stainless (Pageland, SC), Eagle or Atlanta Fabricators (Atlanta, GA).

4.31 ITEM 31 SHELF, WALL-MOUNTED QUANTITY AS SCHEDULED

A. Provide wall shelf with the following features:

1. 16 gauge stainless steel shelf.
2. Mounted to wall with brackets.
3. 2" rear turn up;1-1/2" front turn down.
4. 14" deep, 120" long.
5. Mount at 66"-AFF.
6. See detail drawings.

B. Wall shelf to be as manufactured by **Select Stainless Model 14WS-12**, LowTemp, Titan Stainless or Atlanta Fabricators.

4.32 ITEM 32 DISPOSER QUANTITY AS SCHEDULED

A. Provide disposer with 3-HP motor, having the following features:

1. Voltage characteristics as scheduled.
2. 15" diameter S/S disposer cone to be welded to item #30, 3-compartment sink.

3. Auto-reversing control center including, magnetic starter(s) and start/stop buttons in stainless steel NEMA 4 enclosure, or better, with disconnect switch.
4. Thermal overload protection either built into motor or in control center.
5. Solenoid and vacuum breaker.
6. Control center to be mounted out of splash zone, under drainboard on stainless steel mounting bracket as shown on details.
7. Coordinate installation of pre-rinse unit (item #30).
8. Low water pressure cutoff, with time delay for water after cut off occurs.
9. Permanently lubricated ball bearings.
10. Tubular stainless steel legs with bullet feet adjustable to 3 inches n either direction.
11. Vinyl isolating ring at cone mounting to reduce noise and vibrations.
12. ½" water inlet to disposer throat.

B. Disposer to be as manufactured by **Insinkerator Model SS-300**, Bus Boy Model B3000, or Hobart, Model FD3/300-1.

4.33 ITEM 33 MOBILE POT AND PAN RACK QUANTITY AS SCHEDULED

A. Provide four-tier polymer shelving unit with tubular uprights and having the following features:

1. Uprights shall be nominal 74" high, numbered at one-inch intervals.
2. Shelf connectors to be wedge lock type with corner collar.
3. Each unit to be free standing.
4. Shelf frames shall be made of steel with electroplated substrate and epoxy finish; shelf mats to be injection molded polypropylene.
5. Arrange using quantities and sizes as shown on plan and drawings.
6. 800-pound per shelf capacity, minimum.

B. Pot & pan rack to be as manufactured by **Metro Model Metro-Max Q Series Q566EG3**, Eagle Lifestor, Amco Plastic Plus.

4.34 ITEM 34 UTILITY CART , THREE-TIER QUANTITY AS SCHEDULED

A. Provide 3-tier utility cart having the following features:

1. Frame-16 gauge, 1" square tubing.
2. 16 gauge reinforced, 18" X 32" stainless steel shelves.
3. All stainless steel construction.
4. Leg and handle bumpers protect walls and furniture.
5. 500 lb. capacity per shelf.
6. 5" all swivel casters.

B. Cart to be as manufactured by **Choice Equipment Model UC20-3321-3,** Win-Holt Model UC-3-2133SS, or Lakeside Model 544.

4.35 ITEM 35 PRE-RINSE UNIT (DISHTABLE) QUANTITY AS SCHEDULED

A. Provide splash-mounted pre-rinse unit having the following features:

1. Flexible stainless steel hose.
2. Self-closing spray nozzle.
3. Two wall support brackets.
4. Mixing valve with integral check valves.
5. Deck-mounted.
6. P.C. to provide and install inline check valves above ceiling.

B. Pre-rinse unit to be as manufactured by **T&S Model B-133**, Chicago Faucet or pre-approved equal.

4.36 ITEM 36 CASHIER STAND QUANTITY AS SCHEDULED

A. Provide modular counter of size and content as shown on plan and detail drawings, having the following features to match items 42,43, 45 & 46:

1. 36” high basic counter section with seamless molded fiberglass body flame retardant per ASTM E-162 and flame spread of 25 or less.
2. Body lines with 18 gauge stainless steel.
3. Base to have open rear storage.
4. 30” wide, 14-gauge stainless steel top with highlight finish, turndown on all sides and corners fully welded, ground, and polished.
5. Solid 12” wide, 14-gauge stainless steel ”V” type tray slide, mounted at 34”-AFF.
6. 1" diameter 18-gauge stainless steel foot rest shall be secured to interior walls.
7. 4” diameter ball-bearing swivel type casters to be non-marking, with brakes on all wheels. Casters to be mounted with interior and exterior bracing for maximum stress relief.
8. 18 gauge stainless steel liner with 1” diameter stainless steel foot rail.
9. One convenience outlet under the top with 120V/1PH/15A outlet with 10-amp circuit breaker.
10. Stainless steel drawer, lockable.
11. Color: By Architect.
12. Provide a 2” diameter ferrule hole with rubber grommet in back of stand with conduit to feed electric cords from keypad to convenience outlet located inside of stand.

B. Cashier stand to be as manufactured by ColorPoint Model 28-CSE, Delfield Model KCS-28, or pre-approved equal modified to match the above specifications.

4.37 ITEM37 SNACK MERCHANDISER QUANTITY AS SCHEDULED

A. Provide beverage merchandiser with the following features:

1. Vertical cooler with single sliding door.
2. Front air intake and rear air discharge.
3. Self-cleaning condenser.
4. Forced air cabinet to chill and hold product between 32-38 degrees F.
5. Provide optional stainless steel exterior.
6. Manufacturers standard interior.
7. Provide optional locking device.
8. Environmentally friendly foamed in place CFC and HCFC-free polyurethane insulation.
9. Self contained system; R290 refrigerant.
10. Anti-corrosion coated evaporator.
11. Cabinet dimensions not to exceed 48”L, 34”D, ±81”H.
12. Electrical characteristics as scheduled; cord & plug with 8’ cord attached.
13. Four heavy-duty adjustable shelves.
14. LED interior lighting.
15. Digital electronic thermostat with frost control.
16. Model SC-48-DXB security cover.
17. Provide optional swivel casters.
18. Color: Black.
19. NSF and UL approved.
20. 5-year compressor warranty.

B. Beverage merchandiser to be as manufactured by **Turbo Air Model TOM-48-DXB**, or pre-approved equal.

4.38 ITEM 38 BEVERAGE MERCHANDISER QUANTITY AS SCHEDULED

A. Provide beverage merchandiser with the following features:

1. Vertical cooler with single sliding door.
2. Front air intake and rear air discharge.
3. Self-cleaning condenser.
4. Forced air cabinet to chill and hold product between 32-38 degrees F.
5. Provide optional stainless steel exterior.
6. Manufacturers standard interior.
7. Provide optional locking device.
8. Environmentally friendly foamed in place CFC and HCFC-free polyurethane insulation.
9. Self contained system; R404A CFC Free refrigerant.
10. Anti-corrosion coated evaporator.
11. Cabinet dimensions not to exceed 36”L, 34”D, ±81”H.
12. Electrical characteristics as scheduled; cord & plug with 8’ cord attached.
13. Four heavy-duty adjustable shelves.
14. LED interior lighting.
15. Digital electronic thermostat with frost control.

16. Side panels; 300 series stainless steel interior.
17. Model SC-36-DXB security cover.
18. Provide optional swivel casters.
19. Color: Black.
20. NSF and UL approved.
21. 5-year compressor warranty.

B. Beverage merchandiser to be as manufactured by **Turbo Air Model TOM-36-SP**, or pre-approved equal.

4.39 ITEM 39 MOP SINK QUANTITY AS SCHEDULED

A. Provide mop sink having the following features:

1. 16 gauge type 304 stainless steel construction.
2. Stainless steel angle brackets.
3. 12” deep, 19"w x 16" front-to-back bowl.
4. 2" drain with strainer grate.
5. Anti-splash double-offset "V" edge.
6. Full skirt.

B. Mop sink to be as manufactured by **Eagle Group Model F1916-12**, or pre-approved equal.

4.39A ITEM 39A SERVICE FAUCET QUANTITY AS SCHEDULED

A. Provide service faucet having the following features:

1. 1/2" hot & cold water connection, 8" O.C.
2. 1/2" B-0969 vacuum breaker.
3. Support rod w/wall bracket & mounting screws.
4. Eterna cartridges s/spring checks & lever handles w/color coded indexes.
5. Mount faucet at 36"-AFF.

B. Faucet to be as manufactured by **T & S Model B-0665-BSTR,** Zurn or Chicago Faucet.

4.40 ITEM 40 MOP HOLDER QUANTITY AS SCHEDULED

A. Provide mop holder having the following features:

1. Holds three mops.
2. Stainless steel construction.
3. Mount faucet at 72"-AFF.

B. Mop holder to be as manufactured by **Eagle Group Model 321688,** or pre-approved equal.

4.41 ITEM 41 POS TERMINAL BY OWNER

A. This item to be provided and installed by Owner.

4.42 ITEM 42 CASHIER STAND QUANTITY AS SCHEDULED

A. Provide modular counter of size and content as shown on plan and detail drawings, having the following features to match items 36, 43, 45 & 46:

1. 36” high basic counter section with seamless molded fiberglass body flame retardant per ASTM E-162 and flame spread of 25 or less.
2. Body lines with 18 gauge stainless steel.
3. Base to have open rear storage.
4. 30” wide, 14-gauge stainless steel top with highlight finish, turndown on all sides and corners fully welded, ground, and polished.
5. Solid 12” wide, 14-gauge stainless steel ”V” type tray slides both sides, mounted at 34”-AFF.
6. 1" diameter 18-gauge stainless steel foot rest shall be secured to interior walls.
7. 4” diameter ball-bearing swivel type casters to be non-marking, with brakes on all wheels. Casters to be mounted with interior and exterior bracing for maximum stress relief.
8. 18 gauge stainless steel liner with 1” diameter stainless steel foot rail.
9. One convenience outlet under the top with 120V/1PH/15A outlet with 10-amp circuit breaker.
10. Stainless steel drawer, lockable.
11. Color: By Architect.
12. Provide a 2” diameter ferrule hole with rubber grommet in back of stand with conduit to feed electric cords from keypad to convenience outlet located inside of stand.

B. Cashier stand to be as manufactured by ColorPoint Model 28-CSE, Delfield Model KCS-28, or pre-approved equal modified to match the above specifications.

4.43 ITEM 43 PLAIN TOP COUNTER QUANTITY AS SCHEDULED

A. Provide modular counter of size and content as shown on plan drawings, having the following features to match items 42, 44, 45 & 46:

1. 36" high basic counter section with seamless molded fiberglass body flame retardant per ASTM E-162 and flame spread of 25 or less.
2. Base to have open storage in rear.
3. Body lines with 18 gauge stainless steel.
4. 30" wide 14-gauge stainless steel top highlight finish with turndown on all sides and corners fully welded, ground, and polished.
5. Solid 12” wide, 14-gauge stainless steel ”V” type tray slide, mounted 34” AFF.

6. 6" high, 5" diameter ball-bearing swivel type casters to be non-marking, with brakes on all wheels. Casters to be mounted with interior and exterior bracing for maximum stress relief.
7. Counter body lined with 18 gauge stainless steel.
8. Line-up locks to be barrel bolt and key slot design with cam locking action placed on opposing corners.
9. Install in banked line-up as shown on drawings.
10. Color: By Architect.

B. Beverage counter to be as manufactured by **ColorPoint Model 60-ST-F,** Delfield KC-60-NU, or pre-approved equal modified to match the above specifications.

4.44 ITEM 44 MILK DISPENSER (Must be open front) QUANTITY AS SCHEDULED

A. Provide mobile milk dispenser having the following features to match items other serving line units:

1. Capacity to hold twelve (12) standard milk cases.
2. Stainless steel interior and exterior.
3. Top mounted forced air refrigeration system.
4. R290 hydrocarbon refrigerant.
5. Sliding lift up and down door(s).
6. Equipped with cord & plug set.
7. Set of 6" high, 5" diameter ball-bearing swivel type casters, with brakes on all wheels.
8. Three-year parts and labor warranty, 5-year compressor warranty.
9. Magnetic snap-in EZ clean door gaskets.
10. Drain plug.

B. Milk counter to be as manufactured by **Beverage Air Model SMF34HC-1-S**, True, Norlake or Continental.

4.45 ITEM 45 HOT SERVING COUNTER QUANTITY AS SCHEDULED

A. Provide modular serving counter of size and content as shown on plan drawings, having the following features to match items, 42, 43 & 46:

1. 36” high basic counter section with seamless molded fiberglass body flame retardant per ASTM E162 and flame spread of 25 or less.
2. Body lined with 18 gauge stainless steel.
3. Base to have under-storage with shelf and fiberglass door panel with locks.
4. 30” wide 14 gauge stainless steel top with highlight finish, square turndown on all sides and corners fully welded, ground and polished.
5. Recessed top to accent 18"x26 sheet pans.
6. Five individually controlled dry/moist wells, with solid state digital controls wired to circuit breaker for current overload protection.

7. Control panel to be hinged for access.
8. Solid 12” wide, 14 gauge stainless steel, ”V” type tray slide, mounted at 34”-AFF.
9. 6” high, 5" diameter ball-bearing swivel type casters to be non-marking, with brakes on all wheels. Casters to be mounted with interior and exterior bracing for maximum stress relief.
10. Solid 10” wide shelf on server side, fold down, and 14-gauge stainless steel.
11. Single-tier tempered glass over shelf with front tempered glass shield that is adjustable to allow attendant or self-service Full sloped front protector to prevent customers from touching food. Ends of top and front tobe 3/8" thick tempered glass.
12. Hatco Glo-Ray Curved Infrared heat strip with LED lights built into the heat strip housing and wired to separate infinite control with on/off switch, and fused as required. Model GR5AL-Black in color.
13. All equipment to be built in accordance with Underwriters Laboratories, Inc. and bear the UL complete Unit listing label, no component parts listed equipment will be accepted, and shall also bear the UL listing seal for safety and certification label for sanitation.
14. Electrical characteristics as scheduled; plug to be 120V-250V/50Amp/TwistLock/4-wire/Male (NEMA 14-50P).
15. Body lined with 18 gauge stainless steel.
16. Hot well drains for each well to be plumbed to common manifold and extended to shut off valve in accessible location. Provide 4' flexible hose to drain.
17. Line-up locks to be barrel bolt and key slot design with cam action placed on opposing corners.
18. Install in banked line-up as shown on drawings.
19. Color: Buy Architect.

B. Hot food serving counter to be as manufactured by **ColorPoint Model 5E5-CPA-F**, Delfield KH-5-NU modified to match the above specifications; or Pre-Approved equal.

4.46 ITEM 46 COLD FOOD SERVING COUNTER QUANTITY AS SCHEDULED

A. Provide modular serving counter of size and content as shown on plan drawings, having the following features to match items, 42, 43 & 46:

1. 36” high basic counter section with seamless molded fiberglass body flame retardant per ASTM E162 and flame spread of 25 or less.
2. Body lined with 18 gauge stainless steel.
3. Base to have under-storage with shelf and fiberglass door panel with locks.
4. 30” wide 14 gauge stainless steel top with highlight finish, square turndown on all sides and corners fully welded, ground and polished.
5. Mechanically cooled refrigerated cold pan, 66-3/8" long; 1/4" coved corners.
6. Fully hermetic condensing unit to operate on R134A refrigerant.
7. Food pans to be supported by full length removable brackets located 3" below top.
8. Solid 12” wide, 14 gauge stainless steel, ”V” type tray slide, mounted at 34”-AFF.
9. 6” high, 5" diameter ball-bearing swivel type casters to be non-marking, with brakes on all wheels. Casters to be mounted with interior and exterior bracing for maximum stress relief.

10. Solid 10” wide shelf on server side, fold down, and 14-gauge stainless steel.
11. Single-tier tempered glass over shelf with front tempered glass shield that is adjustable to allow attendant or self-service . Full sloped front protector to prevent customers from touching food. Ends of top and front to be 3/8" thick tempered glass.
12. All equipment to be built in accordance with Underwriters Laboratories, Inc. and bear the UL complete Unit listing label, no component parts listed equipment will be accepted, and shall also bear the UL listing seal for safety and certification label for sanitation.
13. Electrical characteristics as scheduled; cord & plug set NEMA 5-15P.
14. Body lined with 18 gauge stainless steel.
15. Cold pan pitched to 1" drain that extends to shut off valve in accessible location; provide 4' S/S flexible hose to drain.
16. Line-up locks to be barrel bolt and key slot design with cam action placed on opposing corners.
17. Install in banked line-up as shown on drawings.
18. Color: Buy Architect.

B. Hot food serving counter to be as manufactured by **ColorPoint Model 74-CFMX-F**, Delfield KCSC-74 modified to match the above specifications; or Pre-Approved equal.

4.47 ITEM 47 SPARE NUMBER

4.48 ITEM 48 PASS-THRU WARMING CABINET QUANTITY AS SCHEDULED

A. Provide one-section pass-thru hot cabinet having the following features:
NOTE: Items 29, 48 & 49 must be provided by the same manufacturer.

1. Full height stainless steel doors on kitchen side, full solid stainless steel doors on serving side, hinged as shown on equipment plan drawing.
2. Stainless steel exterior and interior.
3. Removable, universal pan slides, each half-section.
4. Voltage characteristics as scheduled.
5. Set of 6” high adjustable stainless steel legs, with stainless steel toe plate attached to legs on serving side.
6. Stainless steel trim strip to seal cabinet to all adjacent building surfaces.
7. Install cabinet so that controls face kitchen.
8. Top housing to match unit cabinet.
9. Energy Star Certified.

B. Cabinet to be as manufactured by **Victory Model HS-1D-PT,** Traulsen Model RHF132WP, or Continental Model DL1W-SS-PT.

4.49 ITEM 49 REFRIGERATOR PASS-THRU QUANTITY AS SCHEDULED

A. Provide one-section pass-thru refrigerator with top mounted air-cooled condensing unit, exterior dial thermometer, cylinder door locks and top mounted condensate evaporator, having the following features:
NOTE: Items 48, 49 and 29 must be provided by the same manufacturer.

1. Full-height stainless steel doors on serving side and kitchen side, hinged as shown on drawings.
2. Stainless steel exterior and interior.
3. Removable, universal type pan slides, both sections.
4. Set of 6” high adjustable stainless steel legs, with stainless steel toe plate attached to legs on serving side.
5. Customized stainless steel trim strips to seal cabinet to adjacent interior and exterior building surfaces at top and sides; bottom left open.
6. Wired for 120V/ph operation, cord & plug set.
7. Install refrigerator so that controls face kitchen.
8. Energy Star Certified.
9. UL and NSF approved.

B. Refrigerator to be as manufactured by **Victory RS-1D-S1-PT,** Traulsen Model RHT-32WPUT, or Continental Model DL1R-SS-PT-HD.

4.50 ITEM 50 ICE MAKER W/BIN QUANTITY AS SCHEDULED

A. Provide cube icemaker and bin having the following features:

1. ICE MAKER:

a. ARI capacity based on 70^{o} F incoming water and 90^{o} F air.
b. Minimum 350 pounds.
c. Self-contained, air-cooled.
d. Electrical characteristics as scheduled.
e. Manufacturer’s standard finishes.
f. Arrange to make dice/crescent cube ice.
g. Water filtration system.
h. Energy Star Certified.

2. BIN:

a. Bin to have minimum capacity of 500 pounds.
b. Manufacturer’s standard finishes.
c. 6 stainless steel legs.
d. ARI certified and rated in accordance with ARI Standard 820-88.
e. NSF listed.
f. Bin adapter.
g. 30" wide.
h. Mount ice maker on bin and install at location on drawings.

3. Water Filter:

   a. Scotsman water filter mode AP1-P

3. Mount Ice Maker on bin and install at location shown on drawings.

B. Ice maker w/bin to be as manufactured by **Scotsman Model C0522MA-1D/B-530**, Ice-O-Matic Model CIM 0530HA/B55 or Manitowac Model IYt-05A/B-570.

END OF SECTION 114000

SECTION 11 52 13.50

PREMIER TAB-TENSIONED SURFACE-MOUNTED FRONT PROJECTION SCREEN

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrically operated, surface mounted, front projection screens.

1.02 REFERENCES

A. NFPA 70 - National Electrical Code.

B. NFPA 701-99 - Fire Tests for Flame-Resistant Textiles and Films.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

B. Wiring diagram for electrically operated units.

C. Shop Drawings: Shop drawings showing layout and types of projection screens. Show the following:
   1. Location of screen centerline.
   2. Location of wiring connections.
   3. Seams in viewing surfaces.
   4. Detailed drawings for concealed mounting.
   5. Connections to suspension systems.
   6. Anchorage details.
   7. Accessories.
   8. Frame details.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.

B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed and other construction where screens will be installed is substantially complete.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Protect screens from damage during delivery, handling, storage, and installation.

1.06 COORDINATION

A. Coordinate work with installation of ceilings, walls, electric service power characteristics, and location.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Draper, Inc., which is located at: 411 S. Pearl P. O. Box 425; Spiceland, IN 47385-0425; Toll Free Tel: 800-238-7999; Tel: 765-987-7999; Fax: 866-637-5611; Email:request info (drapercontract@draperinc.com); Web:www.draperinc.com.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.02 MOTORIZED, SURFACE MOUNTED, FRONT PROJECTION SCREENS

A. Premier: Electric motor operated, pentagonal-shaped steel case, tab tensioned. Metal roller mounted on rubber isolation mounts. Case for sizes through 12 feet x 12 feet AV, 200 inch NTSC, 184 inch HDTV and 189 inch 16:10, is one piece 22 gauge steel with end caps forming universal wall or ceiling hanging bracket. Case for sizes above 12 feet x 12 feet AV, 200 inch NTSC, 184 inch HDTV and 189 inch 16:10, consists of a curved front and L-shaped back/top cover fabricated of extruded aluminum, with endcaps forming ceiling hanging bracket. Case and tensioning dowel finished in flat black.
   1. Motor mounted inside screen roller on rubber isolation insulators. Motor UL certified, rated 110-120V AC, 60 Hz, three wire, instantly reversible, lifetime lubricated with pre-set accessible limit switches.
   2. Motor Screen Controls, UL certified.
      a. Low voltage 24V control unit with hand held RF remote three button control switch to stop or reverse screen at any point, built-in RF receiver, built-in Video Interface Control trigger for 3V-28V, RS232, and dry contact relays.
      b. Key Operated power supply switch to control power to control system.
      c. Motor shall be left mounted.
   3. System Options:
      a. Ceiling Trim Kit for recessing above acoustical tile ceiling grid.
   4. Projection Viewing Surface: Mildew resistant 100 percent vinyl with black masking borders and 12 inch (305 mm) black drop.
      a. Pure White XT1300V - On Axis gain of 1.3. 180 degree viewing cone. For use in situations where lighting is well controlled and where enhanced brightness is needed due to limited projector brightness. Available with or without black backing.
   5. Tab-Tensioning System:
      a. Viewing surface with integrated tabs and cable on each side of fabric to provide tension and ensure flat viewing surface. Viewing surface and tabs CNC cut as a single piece. Tabs RF welded to the back of viewing surface to prevent tab separation. Tab adhesives are not acceptable. Viewing surface inserted into aluminum bottom dowel. Warranted for 5 years against tab separation.
   6. Viewing Area H x W. Black masking borders standard. 12 inch (305 mm) black drop standard.
      a. 16:10 Format. Black masking borders standard.
         1) Size as indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify rough-in openings are properly prepared.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install front projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.

C. Test electrically operated units to verify that screen, controls, limit switches, closure and other operating components are in optimum functioning condition.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 11 60 01

BROADAST, THEATER AND STAGE EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Acoustic room components including the following:
   1. Sound-absorbing and sound-diffusing panels.

1.02 REFERENCES

A. American Society of Civil Engineers (ASCE):
   1. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.

B. ASTM International (ASTM):
   1. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E 413 - Classification for Rating Sound Transmission.
   4. ASTM E795 - Practices for Mounting Test Specimens during Sound Absorption Tests.

C. Underwriter's Laboratory (UL):
   1. UL 723 - Test For Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Delivery, storage, handling, and installation instructions and recommendations.
   2. Maintenance instructions and recommendations.

B. Shop Drawings:
   1. Submit component and project specific installation drawings, cut sheets, and schedules showing all information necessary to fully explain the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. Submit for approval before beginning any fabrication, installation, or erection.
   2. A copy of the Bill of Material shall be included with the submission for approval.
   3. Include fabrication and installation details. Distinguish between factory and field work.
   4. Include plans, elevations, sections, attachments and work by other trades.
   5. Indicate seismic bracing and fastening requirements as applicable.

C. Verification Samples:
   1. Exposed Finishes and Finish Materials: Not less than 4 by 4 inches (102 by 102 mm), for each type, color, pattern, surface and material selected.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain all products from a single manufacturer through one source providing a comprehensive material and installation package:

B. Manufacturer Qualifications: Minimum 5 years' experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened containers with manufacturer's labels attached. Do not deliver material until spaces to receive them are clean, dry, and ready for their installation. Ship to jobsite only after roughing-in, painting and other finishing work has been completed, installation areas are ready to accept work.

B. Handle and install materials to avoid damage.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install materials until spaces are enclosed and weather tight, wet work in spaces is complete and dry, HVAC system is operating and maintaining ambient temperature at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
   1. Coordinate installation and location of blocking and supports as requested.
   2. Verify openings, clearances, storage requirements and other dimensions relevant to the installation and final application.
   3. Where applicable, coordinate locations of electrical junction boxes.

C. Field Measurements: Verify field measurements as indicated on Shop Drawings. Where measurements are not possible, provide control dimensions and templates.
   1. Coordinate locations of electrical junction boxes.

D. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.07 WARRANTY

A. Special Warranty for Acoustic Room Components: Manufacturer's written warranty indicating manufacturer's intent to repair or replace panels that fail in materials or workmanship. Failures are defined to include, but are not limited to, the following:
   1. Fracturing or breaking of unit components which results from normal wear and tear and normal use other than vandalism.
   2. Warping of components not resulting from leaks, flooding, or other uncontrolled moisture or humidity.
   3. Failure of unit to perform acoustically in accordance with manufacturer's published data.
   4. Sound-Absorbing and Sound-Diffusing Panels Warranty Period: 5 years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Wenger Corporation, JR Clancy and GearBoss, which is located at: 555 Park Dr.; Owatonna, MN 55060 ; Toll Free Tel: (800) 4WENGER (493-6437); Tel: (507) 455-4100; Fax: (507) 455-4258; Email: request info (info@wengercorp.com); Web:www.wengercorp.com

B. Requests for substitutions shall be considered in accordance with provisions of Section 01 60 00 - Product Requirements.
   1. Manufacturers seeking approval shall submit the following:
      a. Product data, including third-party certified acoustical data and proposed layout for this project.
      b. Project references: Minimum of 5 installations not less than 3 years old, with owner contact information.
      c. Sample warranty.
   2. Submit substitution request not less than required days prior to bid date.
   3. Approval shall be indicated by issuance of written Addendum.
   4. Approved manufacturers shall meet separate requirements of Submittals Article.

2.02 SOUND-ABSORBING AND SOUND-DIFFUSING PANELS

A. Basis of Design: Provide a system of acoustical panels, as manufactured by Wenger Corporation, that absorb or diffuse sound in a configuration designed to reduce excess sound energy levels and improve sound distribution throughout the space.

B. Performance Requirements: Provide sound absorbing and sound-diffusing panels meeting requirements with the following characteristics:
   1. Wall Panel Mounting Types for Acoustical Performance Characteristics according to ASTM E 795, with measurements determined according to ASTM C 423:
      a. No air space.

C. Wall and Ceiling Absorber Panels: Manufacturer's standard panel, with fabric covering laminated to front face of rigid glass-fiber board, with chemically hardened edges, with the following characteristics:
   1. Basis of Design Product: Wenger Wall Absorber Panel and Ceiling Absorber Panel.
   2. Absorber Panel Size: Width and length indicated on the Drawings.
      a. Thickness: 2 inches (51 mm).
   3. Fabric Covering: Manufacturer's standard, color and pattern as selected.
   4. Wall Panel Mounting Method: Metal wall bracket with panel-mounted z-bracket.
   5. Ceiling Panel Mounting Method:
      a. Direct mount with brackets attached to panel back.
   6. Acoustical Performance, 2 inch (51 mm) thick, Sound Absorption Coefficients, One-third Octave Band Center Frequency, Hz, for 48 by 48 inch (1219 by 1219 mm) unit, Mounting Type A:
      a. 125Hz = 0.50.
      b. 250Hz = 0.96.
      c. 500Hz = 1.27.
      d. 1000Hz = 1.27.
      e. 2000Hz = 1.23.
      f. 4000Hz = 1.18.

D. Fabric Facing Material: 100 percent woven plain weave polyester 2-ply, with the following characteristics:
   1. Light Fastness: AATCC 16, Option 3: 40 hours.
   2. Fastness to Crocking: AATCC 8: #4 Wet & Dry.
   3. Flammability: ASTM E 84, Class A or 1.
   4. Basis of design product: Guilford of Maine, FR-701.

E. Airborne Noise Reduction: Provide acoustical panels in layout designed by computer simulation based on Fitzroy formulas to provide the following sound reduction:
   1. Band Rehearsal: dB +/- 0.5dB.
   2. Orchestra Rehearsal: dB +/- 0.5dB.
   3. Choral Rehearsal: dB +/- 0.5dB.

F. Reverberation Time: Provide acoustical panels in layout designed by computer simulation based on Fitzroy formulas to provide the following reverberation times and amount of variability available in each room:

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine installation areas and mounting surfaces with Installer present, for compliance with manufacturer's installation tolerances including required clearances, floor level, location of blocking and anchoring reinforcements, and other existing conditions that may affect installation or performance.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Proceed with installation only after correction of unsatisfactory conditions.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION - GENERAL

A. Install manufactured units in accordance with manufacturer's recommendations, approved submittals, and in proper relationship with adjacent construction.

B. Clean exposed surfaces. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

3.04 INSTALLATION OF ACOUSTIC ROOM COMPONENTS

A. Install housings utilizing manufacturer's supplied brackets and fasteners recommended for application. Adjust upper and lower limits individually after installation.

3.05 FIELD QUALITY CONTROL

A. Inspect installed work to verify compliance with requirements.
   1. Verify that HVAC work and electrical work complies with manufacturer's submittals and written installation requirements.
   2. Perform installation and startup checks as recommended by manufacturer.
   3. Prepare inspection reports and submit to Architect.

3.06 CLEANING AND PROTECTION

A. Repair or replace defective work as directed by Architect upon inspection.

B. Clean surfaces. Touch up marred finishes, or replace damaged components that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by manufacturer.

C. Protect installed products from damage, abuse, dust, dirt, stain, or paint until completion of project. Do not permit use during construction.

END OF SECTION

SECTION 11 66 23

GYMNASIUM EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Basketball equipment.
   2. Volleyball equipment.
   3. Safety pads.

B. Related Requirements:
   1. Section 03 30 00 "Cast-in-Place Concrete" for installation of floor insert sleeves to be cast in concrete slabs.
   2. Section 09 64 66 "Wood Athletic Flooring" for game lines and markers.
   3. Section 11 66 53 "Gymnasium Dividers."

1.02 DEFINITIONS

A. BWF: Badminton World Federation.

B. FIBA: Federation Internationale de Basketball Amateur (The International Basketball Federation).

C. FIVB: Federation Internationale de Volleyball (The International Volleyball Federation).

D. NCAA: The National Collegiate Athletic Association.

E. NFHS: National Federation of State High School Associations.

F. USAV: USA Volleyball.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
   2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

B. Shop Drawings: For gymnasium equipment, including scoreboard.
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
   3. Include transport and storage accessories for removable equipment.

C. Samples: For each exposed product and for each item and color specified.

D. Samples for Initial Selection: For each type of gymnasium equipment.

E. Samples for Verification: For the following products:
   1. Basketball Net: Full size.
   2. Volleyball Badminton Net: Minimum 12-inch (305-mm) length by full height, including one edge and net accessories.
   3. Volleyball Badminton Floor Insert: Full-size unit.
   4. Volleyball Badminton Post Standard: Full-size unit with net tensioner.
   5. Pad Fabric: Wall padding not less than 3 inches (76 mm) square, and corner and column Samples not less than 3 inches (76 mm) long, with specified treatments applied. Mark face of material.

1.04 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Court layout plans, drawn to scale, and coordinated with floor inserts, game lines, and markers applied to finished flooring.

B. Qualification Data: For Installer.

C. Product Certificates: For each type of gymnasium equipment.

D. Sample Warranty: For special warranty.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.07 FIELD CONDITIONS

A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify position and elevation of floor inserts and layout for gymnasium equipment.

1.08 COORDINATION

A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.09 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium equipment that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Basketball backboard failures including glass breakage.
      b. Faulty operation of basketball backstops.
   2. Warranty Period: 10 years from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain gymnasium equipment from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Basketball backstops and anchors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

2.03 BASKETBALL EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Draper Inc.
   2. Performance Sports Systems. (Basis of Design)
   3. Porter Athletic Equipment Company.
   4. Progressive Sports Construction Group.

B. General: Provide equipment complying with requirements in NCAA's "Men's and Women's Basketball Rules."

C. Protruding fasteners or exposed bolt heads on front face of backboards are not permitted.

D. Provide manufacturer's recommended connections complying with Section 05 50 00 "Metal Fabrications" of size and type required to transfer loads to building structure.

E. Ceiling Suspended Forward Fold Backstops:
   1. Model No. 3107 “Single Post” ceiling suspended, forward fold, front braced backstop as manufactured by Performance Sports Systems, Noblesville, Indiana.
   2. “Single Post” vertical main mast assembly shall be constructed of 6-5/8’’ O.D. (.120” wall ASTM A-500 Grade B) structural steel tubing with diagonal side sway braces of 2 ½”X 1 ½” X14 gauge ASTM A-513 rectangular steel tube sway braces miter cut and welded in place to a top horizontal 4” x 1 ½” x 0.18” web ASTM A-36 steel channel. Sway braces shall attach to mast above backboard for maximum rigidity. Mast and sway braces shall be welded for ceiling heights up to thirty (30) feet. Mast and sway braces shall be clamped for ceiling heights over thirty (30) feet (Model 3106). Backstop shall be front braced and fold forward. Front brace assembly shall have a fully adjustable folding knee joint allowing for exact playing position and maintenance free operation.
   3. Goal shall be mounted directly through backboard into a heavy structural steel weldment which shall be clamped to vertical 6-5/8’’ O.D. center mast. (This direct attachment feature transfers the load on the goal directly to the mast pipe minimizing stress to glass backboard). Goal and backboard mounting design shall conform to NCAA, NFSHSA and FIBA regulations
   4. The all-welded “Single Post” design shall be suspended from custom adjustable hangers with bronze bushings designed to be offset no less than 4” behind the center line of gravity of mast, providing for proper weighting of the assembly and insuring that unit locks securely and automatically into playing position.
   5. Backstop shall be supported from 3-1/2’’ O.D. pipe anchored to roof framing members by means of heavy formed steel support fittings. Superstructure pipes to be reinforced with special bridging or bracing when truss centers exceed spans of fourteen (14) feet. Each attachment clamp must be capable of supporting static loads of at least 10,000 lbs. with no deflection.
   6. All metal parts shall have factory applied powder coat finish in standard black. Available colors: white, blue, red, gray, and yellow.
   7. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
      a. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced rules.
      b. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
      c. Breakaway Characteristics: Positive-lock movable breakaway design, with manufacturer's standard breakaway mechanism including preset pressure release, set to release at 230-lb (105-kg) load, and automatic reset. Provide movable ring with rebound characteristics identical to those of fixed, nonmovable ring.
      d. Field Adjustment: Provide rim that is field-adjustable for rebound elasticity without being removed from the backboard.
      e. Mount: Front.
      f. Net Attachment: No-tie loops for attaching net to rim without tying.
      g. Finish: Polyester powder-coat finish.
   8. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches (380 to 460 mm) long, sized to fit rim diameter, and as follows:
      a. Cord: Made from white nylon.
   9. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports as required by referenced rules.
      a. Attachment: Bolt on.
      b. Color: As selected by Architect from manufacturer's full range.

F. Ceiling Suspended Rear Fold Backstops:
   1. Model No. 3105 “Single Post” ceiling suspended, rear fold, rear braced backstop as manufactured by Performance Sports System., Noblesville, Indiana.
   2. “Single Post” vertical main mast assembly shall be constructed of 6-5/8’’ O.D. (.120” wall ASTM A-500 Grade B) structural steel tubing with diagonal side sway braces of 2 ½”X 1 ½” X14 gauge ASTM A-513 rectangular steel tube sway braces miter cut and welded in place to a top horizontal 4” x 1 ½” x 0.18” web ASTM A-36 steel channel. Sway braces shall attach to mast above backboard for maximum rigidity. Mast and sway braces shall be welded for ceiling heights up to thirty (30) feet. Mast and sway braces shall be clamped for ceiling heights over thirty (30) feet (Model 3104). Backstop shall be rear braced and fold to rear. Rear brace assembly shall have fully adjustable folding knee joint allowing for exact playing position and maintenance free operation.
   3. Goal shall be mounted directly through backboard into a heavy structural steel weldment which shall be clamped to the vertical 6-5/8’’ O.D. center mast. (This direct attachment feature transfers the load on the goal directly to the mast to minimize stress to glass backboard). Goal and backboard mounting design shall conform to NCAA, NFSHSA and FIBA regulations
   4. The all-welded “Single Post” design shall be suspended from custom adjustable hangers with bronze bushings designed to be offset no less than 4” behind the center line of gravity of mast, providing for proper weighting of the assembly and insuring that unit locks securely and automatically into playing position.
   5. Backstop shall be supported from 3-1/2’’ O.D. pipe anchored to roof framing members by means of heavy formed steel support fittings. Superstructure pipes to be reinforced with special bridging or bracing when truss centers exceed spans of fourteen (14) feet. Each attachment clamp must be capable of supporting static loads of at least 10,000 lbs. with no deflection.
   6. All metal parts shall have factory applied powder coat finish in standard black. Available colors: white, blue, red, gray, and yellow.
   7. Basketball Goals: Complete with flanges, braces, attachment plate, and evenly spaced loops welded around underside of ring.
      a. Single-Rim Basket Ring Competition Goal: Materials, dimensions, and fabrication complying with referenced rules.
      b. Type: Movable, breakaway design with manufacturer's standard breakaway mechanism and rebound characteristics identical to those of fixed, nonmovable ring.
      c. Breakaway Characteristics: Positive-lock movable breakaway design, with manufacturer's standard breakaway mechanism including preset pressure release, set to release at 230-lb (105-kg) load, and automatic reset. Provide movable ring with rebound characteristics identical to those of fixed, nonmovable ring.
      d. Field Adjustment: Provide rim that is field-adjustable for rebound elasticity without being removed from the backboard.
      e. Mount: Front.
      f. Net Attachment: No-tie loops for attaching net to rim without tying.
      g. Finish: Polyester powder-coat finish.
   8. Basketball Nets: 12-loop-mesh net, between 15 and 18 inches (380 to 460 mm) long, sized to fit rim diameter, and as follows:
      a. Cord: Made from white nylon.
   9. Backboard Safety Pads: Designed for backboard thickness indicated and extending continuously along bottom and up sides of backboard and over goal mounting and backboard supports as required by referenced rules.
      a. Attachment: Bolt on.
      b. Color: As selected by Architect from manufacturer's full range.

G. Electric Winch:
   1. Model No. 1194 Electric Backstop Winch by Performance Sports Systems, Noblesville, IN.
   2. Electric winch shall be a definite purpose electric winch designed specifically for use of basketball backstop positioning. Winch shall be worm gear type designed to hold backstop at any position during operation. Winch will be driven by a 3/4 HP, 120-volt, 60 hertz, single-phase instant reversing electric motor with thermal overload protection (governed to stall at 14 amps to prevent overload) and manufactured to NEMA specifications. Winch shall develop over 1000 lbs. of line pull at a speed of nine (9) feet per minute.
   3. Winch shall have high-speed worm gearing to support both radial and thrust loads, and positive locking double reduction gear drive providing 200:1 reduction rate for strong cable hold under load, eliminating need for special brakes. Sealed gear case for lifetime maintenance free operation.
   4. Winch shall incorporate a large 4-1/2” diameter grooved drum to assure long cable life and proper coiling, with a tension roller for correct cable tracking even in slack conditions. Drum shall be grooved for 1/4" 7 x 19 galvanized aircraft cable to facilitate smooth take-up and proper spooling of cable. Drum shall allow 25 feet of travel on one (1) layer and 40 feet on two (2) layers.
   5. Winch shall utilize a flush mounted single keyed switch to both raise and lower backstop (eliminating the need for two keys). Key switch shall be located so that the backstop is in full view of authorized operator at all times. Optional wireless remote control or keypad control operation available.
   6. Winch shall have five (5) year warranty against material defects and workmanship. Winches with less than a five (5) year warranty shall not be considered equal.

H. Electric Basketball Backstop Height Adjuster:
   1. Model No. 1171 Electric Adjust-A-Goal by Performance Sports System, Noblesville, IN.
   2. Electric height adjuster shall be manufactured of steel using an electrically operated linear actuator to raise and lower backboard from 8’ to 10’ off of finished floor. Linear actuator shall be powered by a 115 volt single-phase motor and contain built in limit switches to ensure safe operation and positive stopping at 8' and 10' heights. Adjust-A-Goal features a direct goal attachment to transfers load of play directly through backboard to support structure. Adjust-A-Goal shall be operated with a flush mounted single keyed switch (eliminating the need to two keys) or portable power wand. Optional wireless remote control or keypad control operation shall be provided.

2.04 VOLLEYBALL EQUIPMENT

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Draper Manufacturing Inc.
   2. Performance Sports Systems. (Basis of Design)
   3. Porter Athletic Equipment Company.
   4. Progressive Sports Construction Group.
   5. Sports Imports.

B. Materials:
   1. Structural steel tubing: Steel, mechanical, round tubing conforming to ASTM A500.
   2. Extruded aluminum tubing: Schedule 80, ASTM B221, alloy 6063 Temper T5.
   3. Aluminum castings: ASTM B85.

C. Floor Sleeves and Covers:
   1. Floor sleeve: Round, mechanical steel tube sleeve welded to steel anchor plate for casting in concrete floor to receive volleyball standard; Floor Sleeve 6400 as manufactured by Performance Sports Systems.
   2. Size: 3-1/2 inches inside diameter by 8-1/2 inches tube and 4 inches square anchor plate.

3. Cover plate: High Strength Polymer recessed mounting flange and 5 inch diameter chrome plated cover.
   a. Cover installed with flat head wood screws.
   b. Opening diameter: 4-1/8 inches.

D. Floor Anchors:
1. Type: Floor anchor to be recessed in wood flooring on concrete substrate and used for securing portable game standards.
2. Construction: Chrome plated, one-piece anchor with spring-loaded flush fairings and adjustment bolt and nut and designed for installation in concrete slab with fast setting grout.
3. Size: 4-11/16 inches long with 3-1/2 inch diameter floor plate provided with wood screws for anchoring to wood floor.

2.05 SAFETY PADS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Basketball Products International.
2. Douglas Sports.
3. Draper Manufacturing Inc.
4. Performance Sports Systems. (Basis of Design)
5. Porter Athletic Equipment Company.
6. Progesssive Sports Construction Group.
7. UCS Spirit.

B. Safety Pad Surface-Burning Characteristics: ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

C. Pad Coverings: Provide safety pad fabric covering that is fabricated from puncture- and tear-resistant, PVC-coated polyester or nylon-reinforced PVC fabric, not less than 14-oz./sq. yd (475-g/sq. m) and treated with fungicide for mildew resistance; with surface-burning characteristics indicated.

D. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board.
1. Backer Board: Not less than 3/8-inch- (9.5-mm-) thick fire-retardant-treated plywood according to AWPA U1, UCFA Fire Retardant Interior.
2. Fill: Multiple-impact-resistant foam not less than 2-inch- (50-mm-) thick bonded polyurethane, 6.0-lb/cu. ft. (96-lb/cu. ft. (96-kg/cu. m) density.
3. Size: Each panel section, 24 inches (600 mm) wide by not less than 72 inches (1800 mm) long.
4. Number of Modular Panel Sections: As indicated.
5. Installation Method: Concealed mounting Z-clips.
6. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for one color.

E. Corner Wall Safety Pads: Wall corner pad consisting of not less than 2-inch- thick, multiple-impact-resistant, closed-cell, polyethylene-foam filler, covered on both sides and all edges by fabric covering with backer board and manufacturer's standard anchorage to wall.
1. Length: Each pad matching length of wall safety pads.
2. Fabric Covering Color(s): As selected by Architect from manufacturer's full range for one color.

F. Column Safety Pads: Pads covering exposed flange of columns to height indicated, consisting of not less than 2-inch-thick, multiple-impact-resistant, closed-cell, polyethylene-foam filler, covered on both sides and all edges by fabric covering with self-adhesive, hook-and-loop attachment to exposed face of column.
   1. Length: Each pad matching length of wall safety pads.
   2. Fabric Covering Color(s): Match Architect's sample As selected by Architect from manufacturer's full range for one color.

G. Cut-out Trim: Provide manufacturer's standard flanged cut-out trim kits for fitting pads around switches, receptacles, and other obstructions.
   1. Color: As selected by the Architect

H. Basis of Design: Performance Sports Systems as follows:
   1. Column Padding: Model No. 4510.
   2. Wall Padding: Model No. 4199.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
   1. Verify critical dimensions.
   2. Examine supporting structure, [subgrades,]subfloors, and footings below finished floor.
   3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.

B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.

C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
   1. Floor Insert Location: Coordinate location with application of game lines and markers.
   2. Floor Insert Elevation: Coordinate installed heights of floor insert with installation of finish flooring and floor-plate type.
   3. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.

D. Floor Insert Setting: Position sleeve in oversized, recessed voids in concrete slabs. Clean voids of debris. Fill void around sleeves with grout, mixed and placed to comply with grout manufacturer's written instructions. Protect portion of sleeve above subfloor from splatter. Verify that sleeves are set plumb, aligned, and at correct height and spacing; hold in position during placement and finishing operations until grout is sufficiently cured. Set insert so top surface of completed unit is flush with finished flooring surface.

E. Wall Corner Column Safety Pads: Mount with bottom edge at 4 inches (102 mm) above finished floor.

F. Cut-out Trim: Limit cuts in face of padding from trim unit's corner-to-corner outside dimensions. Install with ends of cuts concealed behind trim flange.

G. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.

H. Connections: Connect electric operators to building electrical system.

I. Removable Gymnasium Equipment and Components: Assemble in place to verify that equipment and components are complete and in proper working order. Instruct Owner's designated personnel in properly handling, assembling, adjusting, disassembling, transporting, storing, and maintaining units. Disassemble removable gymnasium equipment after assembled configuration is approved by [Architect] [Owner], and store units in location indicated on Drawings.

3.03 ADJUSTING

A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

3.04 CLEANING

A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION

SECTION 11 66 53

GYMNASIUM DIVIDERS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fold-up divider curtain.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Motors: Show mounting arrangements and wiring diagram to power source and controls.

B. Shop Drawings: For gymnasium dividers.
   1. Include plans showing alignment of curtains in relation to court layout.
   2. Include elevations, sections, details, and attachments to other work.
   3. Include system clearances, stacking requirements, and limits for fitting into adjacent construction.
   4. Include loads, point reactions, and locations for attachment of gymnasium dividers to structure.

C. Samples for Initial Selection: For type of gymnasium divider curtain fabric.

D. Samples for Verification: For divider curtain fabric, not less than 12 inches (305 mm) square of mesh and of solid fabric.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of gymnasium divider.

C. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gymnasium dividers to include in operation and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not install gymnasium dividers until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Verify size of space, available clearances, obstructions, and position for gymnasium dividers.

1.07 COORDINATION

A. Coordinate installation of overhead-supported gymnasium dividers and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Electrically Operated Dividers: Coordinate electrical requirements for type and location of power supply, conduit, wiring, and control boxes.

1.08 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of gymnasium dividers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:

a. Faulty operation of gymnasium dividers.
b. Tearing or deterioration of fabric, seams, or other materials beyond normal use.

2. Warranty Period: Five years from date of Final Acceptance.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Draper, Inc.
2. Performance Sports Systems; Model No. 4020. (Basis of Design)
3. Porter Athletic Company
4. Progressive Sports Construction Group.

B. Source Limitations: Obtain gymnasium dividers from single source from single manufacturer.

2.02 FOLD-UP DIVIDER CURTAIN

A. Model 4020 Fold Up: Electrically operated, fold-up gymnasium divider including motor, cables, controls, clamps for attachment to building structure, threaded rod supports, and other components required for complete functional installation; Fold-Up Gym Divider as manufactured by Performance Sports Systems, Noblesville, IN.

B. Operation: Curtain moves by accordion fold-up action as bottom steel pipe is raised by hoist lines passing through grommets.

C. Configuration: Rectangular shape with straight bottom and extending across room as indicated on Drawings.
1. Stored divider dimensions from bottom of structural support to bottom of folded curtain:
a. Maximum: 42 inches
b. Minimum: 30 inches
2. Minimum required clearance between vertical curtain edges and adjacent fixed objects: 6 inches.
3. Provide 36 inches space between curtain ends and walls or fixed objects to allow passage space around divider.

D. Operating mechanism: Drive pipe winch powered with 1 HP, 110VAC, 60-cycle, single-phase, reversible capacitor, C-Face motor with thermal overload protection. Entire winch assembly to be UL listed and shall carry a five-year warranty. Provide with load holding worm gear reduction and integral limit switches to control curtain travel. Drive pipe shall rotate in pipe support assemblies spaced at approximately 8 to 12 feet.

E. Attachment: Attach to structural support with beam clamps, hanger brackets, and 1/2 inch diameter threaded rods. Attachment clamps designed to be capable of supporting a minimum of 5,000 lbs each and provided in sufficient number to provide a combined minimum 45:1 attachment point safety factor.

F. Hoist lines: 1/8 inch diameter steel cable with 2,000 pounds minimum breaking strength attached to bottom batten and passing through curtain grommets at 18 inches to terminate at top drive pipe. Space lines at approximately 111 inches.
1. Divider bottom: Hoist lines secured to 1-5/8 inches diameter steel pipe batten in 6 inches wide padded curtain pocket

G. Material:
1. The lower section, height shall be specified at time of order, shall be solid 19 oz. or 22 oz. polyester reinforced, fire retardant and mildew resistant vinyl fabric. Seams shall be electronically welded with a full contact weld. A padded pocket shall be formed in the bottom edge of the curtain to accommodate a 1-7/9 inch OD bottom support pipe. Upper portion of curtain shall be a 9-oz. vinyl coated polyester mesh. A pocket shall be formed in the top edge to accommodate a 1-7/8 inch OD top support pipe. Curtain shall stop 2 inches above the finish floor.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for alignment of mounting substrates, installation tolerances, operational clearances, building electrical system connection types and locations, and other conditions affecting performance of the Work.
   1. Verify critical dimensions.
   2. Examine supporting structure.
   3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Comply with manufacturer's written installation instructions.

B. Unless otherwise indicated, install gymnasium dividers after other finishing operations, including painting, are completed.

C. Gymnasium Dividers and Components: Install level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
   1. Verify clearances for movable components of gymnasium dividers throughout entire range of operation and for access to operating components.

D. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure gymnasium dividers to structural support and to properly transfer load to in-place construction.

E. Connections: Connect automatic operators to building electrical system.

F. Install control switch such that operator has view of complete gymnasium divider during lowering and raising.

G. Adjust limit switches of electric winch to ensure accurate position in both stored and lowered positions.

3.03 ADJUSTING

A. Adjust movable components of gymnasium dividers to operate safely, smoothly, easily, and quietly, free from binding, warp, distortion, uneven tension, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and moving parts.

B. Limit Switch Adjustment: Set and adjust upper and lower limit controls.

3.04 CLEANING

A. After completing gymnasium divider installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.

B. Replace gymnasium divider components and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium dividers.

END OF SECTION

SECTION 12 24 13

MANUAL WINDOW SHADE SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Manually-operated window shades and accessories for sun/glare/heat control.

1.02 SUBMITTALS

A. Product Data: Manufacturer's catalog data, product descriptions, installation instructions, detail sheets, and specifications for each type system specified.

B. Samples for Selection: Manufacturer's color chart or sample set.

C. Shop Drawings: Prepared specifically for this project; show dimensions and interface with other products.
   1. Room schedule including field-verified dimensions of each opening to receive window shade systems.
   2. Indicate System Series, operator, fabric selection, and mounting type.
   3. Indicate control type.

1.03 QUALITY ASSURANCE

A. Installer: Approved by manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original cartons.

B. Individually package and mark shades with room number and opening number.

C. Inspect the materials upon delivery to assure that specified products have been received.

D. Store and handle shades to prevent damage to fabrics, finishes, and operators prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer: MechoShade Systems, Inc., 42-03 35th Street, Long Island City, NY 11101. Tel: (718) 729-2020, Fax: (718) 729-2941.

B. Other Acceptable Manufacturers:
   1. Draper.
   2. Hunter Douglas Inc.
   3. Levolar.

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. Provide all window shade system from a single manufacturer.

2.02 MANUFACTURED UNITS

A. Manually-Operated Shades: Mecho 5.

2.03 FABRICS

A. EuroVeil 5300 group, suncreen, dense basket weave, 5% openess factor.
   1. Color: As selected by Architect from manufacturer's full line.

2.04 COMPONENTS

A. Mounting Brackets: Stamped steel, custom fabricated as required for ceiling mounting.

B. Roller Idler Assembly for Manual Shades: Clutch operated rollers incorporating high-strength fiberglass-reinforced polyester gudgeon, which snaps-locks into mounting bracket.

C. Draw Bar: Custom extruded of 6063-T5 aluminum, 1-1/2 inches (38.1 mm) wide by length, electrostatically coated; include provision for weight, if needed.

D. Top Roller Box and End Caps: Four-sided, interlocking box and cover custom-extruded of 6063-T5 aluminum, 0.062 inch (1.57 mm) minimum wall; electrostatic finish.
   1. Size: 5 inches (127 mm).
   2. End Caps: 16 gage steel, electrostatic finish, incorporating mounting brackets.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install window shade systems in accordance with manufacturer's instructions and these specifications.

B. Assume responsibility for all field dimensions and mounting surfaces.

C. Adjust window shade systems for proper operation.

3.02 LOCATIONS - AS SCHEDULED ON THE DRAWINGS

END OF SECTION

SECTION 12 36 00

COUNTERTOPS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters tops.

C. Sinks molded into countertops.

D. Epoxy resin sinks.

1.02 RELATED REQUIREMENTS

A. Section 06 4113 - Wood-Veneer-Faced Architectural Cabinets.

B. Section 06 41 16 - Plastic-Laminate-Faced Architectural Cabinets.

1.03 REFERENCE STANDARDS

A. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material.

E. NEMA LD 3 - High-Pressure Decorative Laminates.

F. PS 1 - Structural Plywood.

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

B. Shop Drawings: Complete details of materials and installation .

C. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

D. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.

1. Laminate Sheet: NEMA LD 3, Grade HGS, HGS, 0.048 inch (HGS, 1.2 mm)0.048 inch (1.2 mm) nominal thickness.
    a. Manufacturers:
        1) Formica Corporation: www.formica.com/#sle.
        2) Lamin-Art, Inc: www.laminart.com/#sle.
        3) Panolam Industries International, Inc Nevamar: www.nevamar.com/#sle. (Basis of Design)
        4) Wilsonart: www.wilsonart.com/#sle.
    b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
    c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
    d. Finish: See Finish Legend.
    e. Surface Color and Pattern: See Finish Legend.
2. Exposed Edge Treatment: As detailed on the Drawings.
3. Back and End Splashes: Same material, same construction.

C. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
1. Manufacturers:
    a. Durcon, Inc: www.durcon.com/#sle. (Basis of Design)
    b. Prime Industries, Inc: www.piilab.com/#sle.
    c. Substitutions: See Section 01 60 00 - Product Requirements.
2. Flat Surface Thickness: 1 inch (25 mm), nominal.
3. Chemical-Resistance: Provide products that resist the following chemicals with not more than Moderate Effect when tested in accordance with NEMA LD 3:
4. Flammability: Self-extinguishing, when tested in accordance with ASTM D635.
5. Surface Finish: Smooth, non-glare.
6. Color: See Finish Legend.
7. Exposed Edge Shape: As indicated on the Drawings.
8. Back and End Splashes: Same material, same thickness; separate for field attachment.
9. Sinks: Same material, same color; molded in one piece with sloped rabbeted lip sealed to countertop; bottom sloped to outlet; molded outlets; drain outlet located in back corner.
    a. Sides and Ends: 1/2 inch (12 mm) minimum thickness.
    b. Bottoms: 5/8 inch (16 mm) minimum thickness.
    c. Interior Corners: 1 inch (25 mm) minimum radius.
    d. Clamping collars for 1-1/2 or 2 inch (38 or 50 mm) diameter waste pipe, for sealed but not permanent connection.
    e. Steel channel supports front to back on each side, fastened to underside of top to support twice full sink weight.
10. Fabricate in accordance with manufacturer's standard requirements.

D. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting self-supporting over structural members.
1. Flat Sheet Thickness: 3/4 inch (19 mm), 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: www.avonitesurfaces.com.
        2) Dupont: www.corian.com.
        3) Formica Corporation: www.formica.com.
        4) Wilsonart: www.wilsonart.com.
        5) Substitutions: See Section 01 60 00 - Product Requirements.

b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
c. Finish on Exposed Surfaces: See Finish Legend.
d. Color and Pattern: See Finish Legend.

3. Other Components Thickness: 3/4 inch (19 mm), minimum.
4. Exposed Edge Treatment: See Finish Legend.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.

2.02 MATERIALS

A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

B. Supporting Brackets: Steel brackets shall be supplied and installed by countertop manufacturer. Provide brackets as required for complete support of countertops.

C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

D. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

A. Fabricate tops 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 (25 mm) 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.
2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, braces, and steel brackets as indicated on drawings or required, finished to match countertops.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 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.

3.03 INSTALLATION

A. Securely attach countertops using steel brackets. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).

C. Attach epoxy resin countertops using compatible adhesive.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.05 CLEANING

A. Clean countertops and shelving surfaces thoroughly.

3.06 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

SECTION 12 66 13

TELESCOPING BLEACHERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Telescoping bleachers.

B. Electric motor operators, controls, and internal wiring.

1.02 REFERENCE STANDARDS

A. NFPA 102 - Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures.

1.03 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage handling and requirements.
   3. Installation methods.

B. Shop Drawings: Complete layout with dimensions, seat heights, row spacing and rise, aisle widths and locations, points of connection to substrate, assembly dimensions, and material types and finishes.
   1. Provide drawings customized to this project.
   2. Include Professional Engineer's seal on each sheet.
   3. Wiring Diagrams: Show locations of motors, electrical wiring, and rough-in connections.

C. Selection Samples: For each material for which color selection is required, submit samples, 2 by 2 inches (50 by 50 mm) in size, illustrating colors and finishes available.

D. Operation and Maintenance Data: Manufacturer's operation and maintenance instructions, including annual inspection and maintenance and bi-annual inspection by a Professional Engineer or manufacturer factory service personnel.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Manufacturer's installation crew.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store, in original packaging, under cover and elevated above grade.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion. Replace parts that fail under normal use at no extra charge to Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Telescoping Bleachers:
   1. Interkal LLC: www.interkal.com/#sle.
   2. Irwin Telescopic Seating Company: www.irwintelescopicseating.com/#sle.
   3. Hussey Seating Company: www.husseyseating.com/#sle. (Basis of Design)

2.02 TELESCOPING BLEACHERS

A. Telescoping Bleachers: Factory assembled tiered benches that retract horizontally into depth approximately the same as a single row depth, with fixed seats mounted on leading edge of platforms.
   1. Provide a design certified by a licensed Professional Engineer licensed in North Carolina.
   2. Design to comply with applicable requirements of NFPA 102 and requirements of code authorities having jurisdiction; where conflicts between requirements occur, comply with whichever is more stringent.
   3. Design with solid fascia (riser) or seat fronts that conceal interior mechanisms when fully retracted, fitting tightly enough to prevent climbing up face; at front row provide key locked, hinged fascia (skirt) to cover gap between seat riser/fascia and floor.
   4. Operation: Motor operated.

B. In addition to its own weight the structure to be designed to withstand;
   1. Floor loading: 5kN/Sq.Metre [104 lbs per sq. ft.]
   2. Horizontal Sway: 7.5%
   3. Max deflection: 1/200 at Design Load.
   4. Side safety rails : 1kN/Metre UDL at 1.1m high. (Adjacent to seats) [68.3 lbs/ft at
   5. Side safety rails : 1.5kN/Metre UDL at 1.1m high. (Adjacent to aisle) [102.4 lbs/ft at

C. Main Platform:
   1. Each main platform assembly (row) to be a lightweight, welded steel space-frame that provides strength, stiffness and accuracy to the whole system. Note systems with bolted together platforms will Not be acceptable. Each platform assembly is constructed from steel tubes and steel pressings of the following sizes;
   2. Front Beam: 76 x 76 x 30 x 2mm (3” x 3” x 1.18” x 0.8”) S275 Pressed Steel Beam.
   3. Rear Beam: 195 x 45 x 2.5mm (7.68” x 1.77” x 0.1”) S275 Pressed Steel Beam.
   4. Supports 50 x 40 x 12.5 x 2 mm (2” x 1.57” x 0.5” x 0.8”) S275 Pressed Steel ‘Top Hat’ Section.
   5. Other Parts: Pressed steel, profiled sections of minimum thickness 3mm.
   6. Finish: Cleaned, de-greased and epoxy powder coated, baked at 180C.
   7. Standard colors: RAL 9005 Satin Black.
   8. Deck (floor): 19mm (0.75”) thick, tongued and grooved, Spruce plywood, bonded to Class 3, BS EN314:1993, listed in BS 5268, Part 2, Section 4 for structural building use and orientated for grain to run front to back on platform space-frame for extra stiffness. Carpet: Ref: Rawson ‘Eurocord’, to client color choice.

D. Main Columns:
   1. Each column is a welded sub-frame with an ‘adjustable cantilever arm’ for height adjustment of each row when installed. Systems without adjustable cantilevers will not be acceptable. There are 2 Main Columns per row of section structure. All columns to be fitted with automatic row latching at floor level and vertical restraints at high level.
   2. Each column foot has 4 wheels installed, giving 8 per row in contact with the floor per row of section.
   3. Wheels: 125mm (5”) diameter x 40mm (1.57”) width c/w nylon hub, polyurethane tyre & roller bearing. Note smaller wheels will not be acceptable.
   4. Column: 100 x 50 x 3.2mm (4” x 2” x 0.126”) steel, Rolled Hollow Section. (Stiffened on Rows 10 to 15 with a secondary 50 x 50 x 3mm (2” x 2” x 0.12”) steel Rolled Hollow Section, and 100 x 50mm (4” x 2”) on rows 16 to 19)
   5. Column Foot: 90 x 50 x 3mm (3.54” x 2” x 0.12”) S275 Steel Pressed Channel.
   6. Finish: Cleaned, de-greased and epoxy powder coated, baked at 180C.
   7. Standard colors: RAL 9005 Satin Black.

E. Column Braces:
   1. Each vertical column is braced diagonally with a bolted brace member connecting column to main platform assembly.
   2. Brace: 40 x 40 x 3mm (1.57” x 1.57” x 0.12”) Steel Angle. (Rows 1 - 5)

3. Brace: 50 x 50 x 2.5mm (2" x 2" x 0.1") Steel R.H.S. (Rows 6 upwards)

F. Platform Guidance:
1. Each row is to be aligned by Parallel Guidance Frames working on the 'scissor' principle to prevent jamming and ensure accurate opening and closing of the telescopic platform.
2. Guide Arms: 40 x 40 x 3mm (1.57" x 1.57" x 0.12") steel angle.
3. Cross Tube: 25 x 25 x 3mm (1" x 1" x 0.12") steel R.H.S.

G. Row To Row Contact:
1. Each row of platforms to transfer load to the row below through moulded nylon Load Transfer Skids, to reduce noise and reduce friction during opening and closing operation.

H. Row To Row Locking:
1. Each main column to lock on opening automatically through gravity action latch locks. These also prevent accidental closing and allow partial opening of rows.

I. Intermediate Steps:
1. Each spectator aisle is fitted with intermediate half-steps, each 1100mm wide and ½ row rise high to ensure safe and easy access up and down the aisle.
2. 2mm (0.08") S275 Steel Pressing c/w full width extruded aluminum, non-slip nosing fixed to front edge c/w integral photo luminescent strips.
3. Step Frame: 2mm (0.08") thick pressed steel, epoxy powder coated finish.

J. Safety Rails:
1. The ends of each seating block row are fitted with a re-moveable safety rail. Each section is re-moved before closing the seating. The rail system to withstand a UDL of 1kN/metre.
2. 50 x 20 x 2mm (2" x 0.79" x 0.08") oval shaped steel top tube.
3. Uprights: 30 x 30 x 2.5mm (1.18" x 1.18" x 0.1") square steel tube.
4. Infill: Vertical steel tubular members at <100mm (4") spacing. 19 x 19 x 1.6mm (0.75" x 0.75" x 0.063") Sq. ERW tube
   a. Or
   b. Panels with laminate finish, laminate to be chosen from the Kronospan range.
   c. Or
   d. Acrylic panels, tinted grey
5. Finish: Cleaned, iron phosphate pre-treatment and epoxy powder to colour choice.

K. Front Fascia:
1. Front fascia to be fitted to the front of each platform to create a closed in, paneled effect when the seating platforms are closed.
2. Fascia 15mm (0.6") thick MDF with laminate finish and edges capped. Laminate to be chosen from the Kronospan range.

L. Row 1 Fascia:
1. Kick Panel: 2.5mm (0.1") S275 Steel Profiled full length panel
2. Finish: Cleaned, iron phosphate pre-treatment and epoxy powder to colour choice.

2.03 SYSTEM OPERATION

A. Power Operation
1. End safety rails to be fitted and removed manually.

B. Power Operation Unit
1. Electrical power operation drive units to be fitted under each Row 1 platform assembly.
2. The system is by the 'friction drive' method, driving onto the hall floor with 4 No. vulcanizeded rubber covered, cast iron drive rollers per unit. There is generally one power unit per telescopic platform module.
   a. Drive Roller:150 (6") dia. x 100 (4") long (4 driving thro 2 No. drive shafts)
   b. Motor: 3 ph, 240v, 60Hz, 0.5Hp, 1.25 SF, 1425 rpm.
   c. Gearbox: Output Ratio = 87:1.

C. The drive rollers are chain driven and so adjustment mechanisms are provided on drive shaft bearings to re-tension chains (if required). The adjustment mechanisms on the opposite side of

the power unit are to provide adjustment of tracking on telescopic platform, when extending and retracting.

D. These units are contained safely within the understructure and require no supervision or maintenance apart from a greasing of the drive chains and bearings and a checking of chain tension during the routine annual maintenance contract.

E. Control Panel
   1. The power operation units are run from a control panel mounted on the wall behind the telescopic platform. The switch gearing for the motors is provided by a Frequency Inverter, which is rated to suit the number of electric motors being controlled. The inverter converts the supply to suit the motors, which means that the power supply to the seating unit is;
      a. Power supply rating: Single Phase (1ph), 120v, 60Hz. Current rating dependent on project.

F. This system provides thermal motor protection, along with variable parameters such as;
   1. Operating speed.
   2. Acceleration
   3. Deceleration.

      Note: Having a gradual acceleration reduces wear on the drive unit, the seating structure and decreases the required starting torque.

G. The control panel is IP65 rated with a door interlocking power isolating switch.

H. Control Pendant
   1. A clearly labelled, low voltage pendant control to be supplied to control the motor drive system.
   2. (To extend or retract the telescopic platform units firstly unscrew the sealing cap on the electrical socket mounted centrally on the low kickboards. Then screw into place the electrical plug of the control pendant.)
   3. The pendant to be supplied with just two arrow marked buttons. Depressing one or the other will slowly start the motors to extend or retract the telescopic platform units. While the motors are in operation an audible warning sounder mounted on the control panel to function.
   4. The control wiring for the control pendant is low voltage dc.

2.04 SEAT COMPONENTS

A. Polymer Seat System - Courtside Collection XC10 (10”):

B. Hussey Courtside Collection Series embodies the latest leading edge innovations in linear telescopic seating modules. Courtside seats utilize a harmonious blend of advanced ergonomic principals, architecturally appealing design, safety, value and performance.

C. Seat Modules: 18" long assembled, gas assisted injection-molded, high density, 100% recyclable HDPE (high density polyethylene) modules in monochromatic colors providing, dual textured scuff resistant 10" wide seat surface with ½” minimum interlock on seat and face. Unit structural tested to 600 lbs. occupant load.
   1. CourtSide XC10 Seat Module
      a. XC10 - 10” Comfort Profile:
         1) 10” depth continuous comfort curve style bench seat module.
         2) Ergonomically contoured forward “waterfall” edge for enhanced spectator comfort and minimization of sensitive pressure point area, regardless of leg positioning.
         3) Fore & Aft contoured seat surface for uniform support and minimize high pressure points under the buttocks.
         4) Seat height ranges from deck to t/o seat range from 16-1/8” to 18-1/8”
         5) 21-1/8” clear foot space area, regardless of leg positioning.
      b. Integrally molded end caps at aisle end locations for clean finished appearance.
      c. Custom color graphic logo design application for end cap insert.(See Personalization and Creativity under Accessories section)

d. Integrally molded recess pockets to accept seat number and row letters.
e. Integrally molded rear closure panel at back of seat to allow for “continuous clean sweep” of debris at deck level and minimized visibility of structural ribbing.

D. Seat Attachment: Each polymer seat module shall be securely anchored by a 12 ga steel clamp bracket that provides steel-to-steel, through bolted attachment to the front nose beam of the bleacher. Attachment eliminates fore / aft movement of the seat module on the nose beam.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are consistent with those on the shop drawings.

B. Verify that electrical rough-ins have been installed and are accessible.

C. Do not begin installation until substrates have been properly prepared and area has been cleared of obstructions.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 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.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Do not field cut or alter seats, fascia, or structural members without approval.

C. Provide manufacturer's field representative to inspect completed installation.

3.04 ADJUSTING

A. Lubricate, test, and adjust each moving assembly to ensure proper operation in compliance with manufacturer's recommendations.

3.05 CLEANING

A. Clean exposed and semi-exposed assembly surfaces.

B. Touch up finishes on damaged or soiled areas.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration and Training: Provide manufacturer's field representative to demonstrate to and train Owner's operating personnel in proper operation of equipment.
1. Location: On site using installed equipment.
2. Time: As agreed between Owner and Construction Manager.

3.07 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

SECTION 14 24 00

MACHINE-ROOM-LESS HYDRAULIC PASSENGER ELEVATORS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Machine room-less hydraulic passenger elevators as shown and specified. Elevator work includes:
   1. Standard pre-engineered hydraulic passenger elevators.
   2. Elevator car enclosures, hoistway entrances and signal equipment.
   3. Operation and control systems.
   4. Jack(s).
   5. Accessibility provisions for physically disabled persons.
   6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
   7. Materials and accessories as required to complete the elevator installation.

B. Related Sections:
   1. Division 01 General Requirements: Meet or exceed all referenced sustainability requirements.
   2. Division 03 Concrete: Installing inserts, sleeves and anchors in concrete.
   3. Division 05 Metals:
      a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
      b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
   4. Division 09 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
   5. Division 26 Sections:
      a. Providing electrical service to elevators, including fused disconnect switches where permitted. (note: fused disconnect switch to be provided as part of elevator manufacture product, see section 2.11 Miscellaneous elevator components for further details.)
      b. Emergency power supply, transfer switch and auxiliary contacts.
      c. Heat and smoke sensing devices.
      d. Convenience outlets and illumination in control room (if applicable), hoistway and pit.
   6. Division 22 Plumbing
      a. Sump pit and oil interceptor.
   7. Division 23 Heating, Ventilation and Air Conditioning
      a. Heating and ventilating hoistways and/or control room.

C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the thyssenkrupp Elevator's proposal, since it is a part of the building construction.
   1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
   2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
   3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
   4. Elevator hoistways shall have barricades, as required.
   5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.

6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. All wire and conduit should run remote from the hoistways.
10. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
11. Install and furnish finished flooring in elevator cab.
12. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
13. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
14. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.
15. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
16. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
17. General Contractor shall fill and grout around entrances, as required.
18. All walls and sill supports must be plumb where openings occur.
19. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
20. Provide telephone line, light fixture (200 lx / 19 fc), and convenience outlet in the hoistway at the landing where the elevator controller is located. Typically this will be at the landing above the 1st floor. Final location must be coordinated with elevator contractor.
21. As indicated by elevator contractor, provide a light outlet for each elevator, in center of hoistway.
22. For signal systems and power operated door: provide ground and branch wiring circuits.
23. For car light and fan: provide a feeder and branch wiring circuits to elevator control cabinet.
24. Controller landing wall thickness must be a minimum of 8 inches thick. This is due to the controller being mounted on the second floor landing in the door frame on the return side of the door. For center opening doors, the controller is located on the right hand frame (from inside the elevator cab looking out). These requirements must be coordinated between the general contractor and the elevator contractor.
25. Cutting, patching and recesses to accommodate hall button boxes, signal fixtures, etc..

1.02 SUBMITTALS

A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.

B. Shop drawings:
   1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
   2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
   3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.

4. Indicate electrical power requirements and branch circuit protection device recommendations.

C. Powder Coat paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.

D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and materials.

E. Metal Finishes: Upon request, standard metal samples provided.

F. Operation and maintenance data. Include the following:
1. Owner's manuals and wiring diagrams.
2. Parts list, with recommended parts inventory.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.
2. The manufacturer shall have a documented, on-going quality assurance program.
3. ISO-9001:2000 Manufacturer Certified
4. ISO-14001:2004 Environmental Management System Certified

B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.

C. Regulatory Requirements:
1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
2. Building Code: National.
3. NFPA 70 National Electrical Code.
4. NFPA 80 Fire Doors and Windows.
5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
6. Section 407 in ICC A117.1, when required by local authorities
7. CAN/CSA C22.1 Canadian Electrical Code
8. CAN/CSA B44 Safety Code for Elevators and Escalators.
9. California Department of Public Health Standard Method V1.1-2010, CA Section 01350

D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).

E. Inspection and testing:
1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
2. Arrange for inspections and make required tests.
3. Deliver to the Owner upon completion and acceptance of elevator work.

1.04 DELIVERY, STORAGE AND HANDLING

A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

1.05 PROJECT CONDITIONS

A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

1.06 WARRANTY

A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

1.07 MAINTENANCE

A. Furnish maintenance and call back service for a period of 12 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
   1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
   2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
   3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Hydraulic Elevators: ThyssenKrupp; Endura MRL Hydraulic Elevator.

B. Other Acceptable Manufacturers - Hydraulic Elevators:
   1. Otis Elevator Company: www.otis.com/#sle.
   2. Schindler Elevator Corporation: www.schindler.com/#sle.

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. Products other than Basis of Design are subject to compliance with specified requirements and prior approval of Architect. By using products other than Basis of Design, the Construction Manager accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier .

2.02 MATERIALS, GENERAL

A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1-2010, CA Section 01350 as mentioned in 1.03.9 of this specification.

B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.

C. Steel:
   1. Shapes and bars: Carbon.
   2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
   3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture’s standard selections.

D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.

E. Flooring by others.

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless telescopic 2-stage. Two jacks piped together, mounted one on each side of the car with each having two telescopic sections designed to extend in a synchronized manner when oil is pumped into the assembly. Each jack section will be guided from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each jack assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. theoiltype

I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform "flooded pit operation", which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.04 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
   1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
   2. An oil hydraulic pump.
   3. An electric motor.
   4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating - motors shall be capable of 80 starts per hour with a 30% motor run time during each start.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
   1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
   2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
   3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
   4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
   5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
   6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
   7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
   8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05 HOISTWAY ENTRANCES

A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolteddown construction.
   1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
   2. Main landing door & frame finish: ASTM A1008 steel panels, factory applied powder coat finish.
   3. Typical door & frame finish: ASTM A 366 steel panels, factory applied powder coat finish.

B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.

C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details

D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
   1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
   2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.

3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

2.06 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:
1. Walls: Cab type a laminate wall design, durable wood core finished on both sides with high pressure plastic laminate.
2. Reveals and frieze: Not applicable
3. Canopy: Cold-rolled steel with hinged exit.
4. Ceiling: Suspended type, LED lighting with translucent diffuser mounted in a metal frame. Framework shall be finished with a stainless steel, no. 4 brushed finish.
5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with No. 4 brushed stainless steel
6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
   a. Door Finish: Stainless steel panels: No. 4 brushed finish.
   b. Cab Sills: Extruded aluminum, mill finish.
7. Handrail: Provide 2'' flat metal bar on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, No. 4 brushed finish.
8. Ventilation: Manufacturer’s standard exhaust fan, mounted on the car top.
9. Protection pads and buttons: Not required

B. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.07 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.
1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.

4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.08 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a No. 4 brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Auxiliary Operating Panel: Not Required

D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

E. Special Equipment: Not Applicable

2.09 CONTROL SYSTEMS

A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Service Panel - to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
1. Access to main control board and CPU
2. Main controller diagnostics
3. Main controller fuses
4. Universal Interface Tool (UIT)
5. Remote valve adjustment
6. Electronic motor starter adjustment and diagnostics
7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit

8. Operation of auxiliary pump/motor (secondary hydraulic power source)
9. Operation of electrical assisted manual lowering
10. Provide male plug to supply 110VAC into the controller
11. Run/Stop button

C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Emergency Power Operation: Full automatic operation (Simplex 10-D4A) Upon loss of the normal power supply, building-supplied standby power is available to the elevator on the same wires as the normal power. Once the loss of normal power has been detected and standby power is available, the elevator is lowered to a pre-designated landing and will open the doors. After passengers have exited the elevator, the doors are closed. At this time the elevator is automatically allowed to continue service using the building-supplied standby power.

E. Special Operation: Not Applicable

2.10 HALL STATIONS

A. Hall Stations, General: Provide buttons with red-illuminating LED halos to indicate that a call has been registered at that floor for the indicated direction. Provide 1 set of pushbutton risers.
   1. Provide one pushbutton riser with faceplates having a No. 4 brushed stainless steel finish.
      a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Hall Position Indicator: Not Applicable

D. Hall lanterns: Not Applicable

E. Special Equipment: Not Applicable

2.11 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.

C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

PART 3 - EXECUTION

3.01 EXAMINATION

A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.02 INSTALLATION

A. Install elevator systems components and coordinate installation of hoistway wall construction.
   1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
   2. Comply with the National Electrical Code for electrical work required during installation.

B. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.

C. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.

D. Welded construction: Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualification of welding operators.

E. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.

F. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.

G. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.

H. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.

I. Lubricate operating parts of system, where recommended by manufacturer.

3.03 FIELD QUALITY CONTROL

A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.04 ADJUSTING

A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

3.05 CLEANING

A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.

B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
   1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

3.06 PROTECTION

A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

3.07 DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.

B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

3.08 ELEVATOR SCHEDULE

A. Elevator Qty. 1
   1. Elevator Model: enduraMRL Above-Ground (2-Stage)
   2. Elevator Type: Hydraulic Machine Room-Less, Passenger
   3. Rated Capacity: 3500 lbs.
   4. Rated Speed: 110 ft./min.
   5. Operation System: TAC32H
   6. Travel: 15'-4"
   7. Landings: 2 total
   8. Openings:
      a. Front: 2
      b. Rear: 0
   9. Clear Car Inside: 6' - 8" wide x 5' - 5" deep
   10. Cab Height: 8'-0" standard
   11. Hoistway Entrance Size: 3' - 6" wide x 7'-0" high
   12. Door Type: Single Speed
   13. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
   14. Seismic Requirements: Zone 1
   15. Hoistway Dimensions: 8' - 4" wide x 6' - 11" deep
   16. Pit Depth: 4' - 0"
   17. Button & Fixture Style: Signa4 Signal Fixtures
   18. Special Operations: None

END OF SECTION

SECTION 14 42 16

VERTICAL WHEELCHAIR LIFTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Enclosed, self-contained vertical platform wheelchair lift.

1.02 RELATED SECTIONS

A. Section 04 20 00 - Unit Masonry: Masonry shaftway and anchor placement.

B. Section 06 10 00 - Rough Carpentry: Blocking in framed construction for lift attachment.

C. Section 09 29 00 - Gypsum Board: Gypsum board shaftway.

D. Division 26 - Electrical: Dedicated telephone service and wiring connections.

E. Division 26 - Electrical: Lighting and wiring connections at top of shaft.

F. Division 26 - Electrical: Electrical power service and wiring connections.

1.03 REFERENCES

A. ASME A17.1 - Safety Code for Elevators and Escalators.

B. ASME A17.5 - Elevator and Escalator Electrical Equipment.

C. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.

D. CSA B44 - Safety Code for Elevators and Escalators.

E. CSA B355 - Lifts for Persons with Physical Disabilities.

F. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.

G. NFPA 70 - National Electric Code.

H. CSA - National Electric Code.

1.04 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Submit manufacturer’s installation instructions, including preparation, storage and handling requirements.
   2. Include complete description of performance and operating characteristics.
   3. Show maximum and average power demands.

B. Shop Drawings:
   1. Show typical details of assembly, erection and anchorage.
   2. Include wiring diagrams for power, control, and signal systems.
   3. Show complete layout and location of equipment, including required clearances and coordination with shaftway.

C. Selection Samples: For each finished product specified, provide two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finished product specified, two samples, minimum size 1-3/4” x 2-1/4” inches, representing actual product, color, and patterns.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Firm with minimum 10 years experience in manufacturing of vertical platform lifts, with evidence of experience with similar installations of type specified.

B. Installer Qualifications: Licensed to install equipment of this scope, with evidence of experience with specified equipment. Installer shall maintain an adequate stock of replacement parts, have qualified people available to ensure fulfillment of maintenance and callback service without unreasonable loss of time in reaching project site.

1.06 REGULATORY REQUIREMENTS

A. Provide platform lifts in compliance with:
   1. ASME A18.1 - Safety Standard for Platform Lifts and Stairway Chairlifts.
   2. ASME A17.1 - Safety Code for Elevators and Escalators.
   3. ASME A17.5 - Elevator and Escalator Electrical Equipment.
   4. NFPA 70 - National Electric Code.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store components off the ground in a dry covered area, protected from adverse weather conditions.

1.08 PROJECT CONDITIONS

A. Do not use wheelchair lift for hoisting materials or personnel during construction period.

1.09 WARRANTY

A. Warranty: Manufacturer shall warrant the wheelchair lift materials and workmanship for two years following completion of installation.

B. Extended Warranty: Provide an extended manufacturer’s warranty for the entire warranty period covering the wheelchair lift materials and workmanship for the following additional extended period beyond the initial two year warranty. Preventive Maintenance agreement required.
   1. Five additional years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Garaventa Lift; United States - P.O. Box 1769, Blaine, WA 98231-1769. Canada - 7505 134A St., Surrey, BC V3W 7B3. ASD. Toll Free: 800-663-6556. Tel: (604) 594-0422. Fax: (604) 594-9915. Email: productinfo@garaventalift.com.

B. Web www.garaventalift.com.

C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 ENCLOSED VERTICAL WHEELCHAIR LIFT

A. Capacity: 750 lbs (340 kg) rated capacity.

B. Mast Height:
   1. Model GVL-EN-42; 45 inches (1143 mm) maximum lifting height.

C. Nominal Clear Platform Dimensions:
   1. Large: 43-1/4 inches (1099 mm) by 60 inches (1522 mm).

D. Platform Configuration:
   1. Straight Through Entry/Exit: Front and rear openings.

E. Landing Openings:
   1. Lower Landing: Door.
   2. Upper Landing: Gate.

F. Doors and Gates: Doors and gates shall be self closing type.
   1. Gate Height: Flush mount, 42-1/8 inches.
   2. Door Construction: Aluminum frame with:
      a. Panels of 16 gauge painted galvanized steel.
   3. Power Door/Gate Operator: Automatically opens the door/gate when platform arrives at a landing. Will also open at landing by pressing call button.
      a. ADA Compliant and obstruction sensitive.
      b. Low voltage, 24 VDC with all wiring concealed.

c. Location:
1) Lower Landing: Door.

G. Lift Components:
1. Machine Tower: Custom aluminum extrusion.
2. Base Frame: Structural steel.
3. Platform Side Wall Panels: 42-1/8 inches high. 16 gauge galvanized steel sheet. Custom aluminum extrusion tubing frame.
4. Enclosure Panels:
a. 16 gauge painted galvanized steel sheet.

H. Enclosure Height Above Upper landing:
1. Enclosure shall extend 42-1/8 inches above the upper landing level

I. Infill Panel Kit: Provide 16 gauge galvanized panels and mounting hardware to cover void between side of enclosure, drive mast and adjacent wall at the following locations:
1. Lower landing.
2. Upper landing.

J. Base Mounting and Access to Lift at Lower Landing:
1. Floor Mount: Base of lift shall be mounted on the floor surface of the lower landing. For access onto the platform provide a ramp of 16 gauge galvanized steel sheet with a slip resistant surface.

K. Leadscrew Drive:
1. Drive Type: Self-lubricating acme screw drive.
2. Emergency Operation: Manual handwheel device to raise or lower platform.
3. Battery Powered Emergency Lowering: Battery powered platform lowering device that automatically activates in the event of power failure. Allows passenger to drive platform downward to lower landing. Does not operate lift in up direction.
4. Safety Devices:
a. Integral safety nut assembly with safety switch.
5. Travel Speed: 10 fpm.
6. Motor: 2.0 hp.
7. Power Supply:
a. 120 VAC single phase; 60 Hz on a dedicated 20 amp circuit.
b. 208/240 VAC, single phase; 50 Hz on a dedicated 16 amp circuit.

L. Platform Controls: 24 VDC control circuit with the following features.
1. Direction Control: Constant pressure rocker switch.
2. Direction Control: Illuminated tactile and constant pressure push buttons with dual platform courtesy lights and safety light.
3. Illuminated and audible emergency stop switch shuts off power to lift and activates audio alarm equipped with battery backup.
4. Keyless operation.
5. Keyed operation.
6. Emergency Telephone: Platform shall be equipped with ADA compliant autodialer telephone with a stainless steel faceplate. Telephone shall operate in the event of power failure. A telephone line shall be supplied to the lift site as specified under Division 16.
7. Arrival Gong and Digital Floor Display.

M. Call Station Controls: 24 VDC control circuit with the following features.
1. Direction Control: Constant pressure rocker switch.
2. Direction Control: Illuminated tactile and constant pressure push buttons with illuminated "In Use" indicator.
3. Keyless operation.
4. Keyed operation.

5. Call Station Mounting:
    a. Lower:
        1) Wall mounted recessed.
    b. Upper:
        1) Wall mounted recessed.

N. Safety Devices and Features:
1. Grounded electrical system with upper, lower, and final limit switches.
2. Tamper resistant interlock to electrically monitor that the door is in the closed position and the lock is engaged before lift can move from landing.
3. Electrical disconnect shall shut off power to the lift.

O. Finishes
1. Aluminum Extrusions: Champagne anodized finish.
2. Ferrous Components: Electrostatically applied baked powder finish, fine textured.
    a. Color: Satin Grey, RAL 7030.
3. Lift Finish: Baked powder coat finish, color as selected by the Architect from manufacturers optional RAL color chart.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Verify shaft and machine space are of correct size and within tolerances.

C. Verify required landings and openings are of correct size and within tolerances.

D. Verify electrical rough-in is at correct location.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 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.

3.03 INSTALLATION

A. Install platform lifts in accordance with applicable regulatory requirements including ASME A 17.1, ASME A 18.1 and the manufacturer's instructions.

B. Install system components and connect to building utilities.

C. Accommodate equipment in space indicated.

D. Startup equipment in accordance with manufacturer’s instructions.

E. Adjust for smooth operation.

3.04 FIELD QUALITY CONTROL

A. Perform tests in compliance with ASME A 17.1 or A18.1 and as required by authorities having jurisdiction.

B. Schedule tests with agencies and Architect, Owner, and Contractor present.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Equipment installation requirements common to equipment sections.
3. Painting and finishing.
4. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. CPVC: Chlorinated polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Mechanical sleeve seals.
2. Escutcheons.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Fire-Suppression Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 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.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for fire-suppression items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 21 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

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, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

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 to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

M. Verify final equipment locations for roughing-in.

N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. 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.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.

2. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.5 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor fire-suppression materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 21 05 13

COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION 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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in fire suppression equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 21 05 17

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. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Flexicraft Industries.
4. GPT; Link-Seal.
5. Metraflex Company (The).
6. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Reinforced Plastic.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Pre-sealed Systems.

B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 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 manufacturer's recommended 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, seal the 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 joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 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.

3.3 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. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

    a. Galvanized-steel wall sleeves.

2. Exterior Concrete Walls below Grade:

    a. Galvanized-steel wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for manufacturer's recommended annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Galvanized-steel wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for manufacturer's recommended annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Galvanized-steel-pipe sleeves or stack-sleeve fittings.

5. Interior Partitions:

    a. Piping Smaller Than NPS 6: Galvanized-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

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 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange.

B. Split-Casting Floor Plates: Cast brass 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:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated 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: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 21 05 48

VIBRATION AND SEISMIC CONTROLS 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. This Section includes the following:
   1. Restraining braces.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

   1. Site Class as Defined in the IBC: Refer to structural drawings.
   2. Assigned Seismic Use Group or Building Category as Defined in the IBC: Refer to structural drawings.

      a. Component Importance Factor: **1.5**.
      b. Component Response Modification Factor: Refer to structural drawings.
      c. Component Amplification Factor: Refer to structural drawings.

   3. Design Spectral Response Acceleration at Short Periods (0.2 Second): Refer to structural drawings.
   4. Design Spectral Response Acceleration at 1-Second Period: Refer to structural drawings.

1.5 SUBMITTALS

A. Product Data: For the following:

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 seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details 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. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Welding certificates.

D. Qualification Data: For professional engineer and testing agency.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC and NFPA 13 unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 SEISMIC-RESTRAINT DEVICES

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:

1. California Dynamics Corporation.
2. Cooper B-Line, Inc.
3. Hilti, Inc.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. Unistrut; a part of Atkore International.
8. VMC Group.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

E. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

F. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

G. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

I. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.2 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

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.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127 and NFPA 13.

2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 13 Section "Water-Based Fire-Suppression Systems" for piping flexible connections.

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. Warning signs and labels.
2. Pipe labels.
3. Stencils.
4. Valve tags.
5. 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.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 WARNING SIGNS AND LABELS

A. A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

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.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.

B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

C. 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: Varies depending on pipe diameter.

D. Pipe-Label Colors:

1. Background Color: Red.
2. Letter Color: White.

2.3 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.

1. Stencil Material: Fiberboard or metal.
2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.4 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 or anodized aluminum, 0.032 inch thick, with predrilled holes for attachment hardware.
2. Fasteners: Brass wire-link chain, beaded chain or S-hook.
3. Valve-Tag Color: 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.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: Varies.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 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.

3.2 LABEL INSTALLATION

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 or permanently fasten labels on each major item of mechanical equipment.

D. Locate equipment labels where accessible and visible.

E. Piping Color-Coding: Painting of piping is specified in Division 09 Section.

F. 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.

G. 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 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 25 feet along each run.

3.3 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in 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: 1-1/2 inches, round.

3.4 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 211200

FIRE-SUPPRESSION STANDPIPES

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. Fire-protection valves.
3. Hose connections.
4. Alarm devices.
5. Pressure gages.

B. Related Sections:

1. Division 21 Section "Wet-Pipe Sprinkler Systems" for wet-pipe sprinkler piping.
2. Division 21 Section "Diesel-Drive, Vertical-Turbine Fire Pumps" for fire pumps, pressure-maintenance pumps, and fire-pump controllers.

1.3 DEFINITIONS

A. Standard-Pressure Standpipe Piping: Fire-suppression standpipe piping designed to operate at working pressure 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Automatic Wet-Type, Class I Standpipe System: Includes NPS 2-1/2 hose connections. Has open water-supply valve with pressure maintained and is capable of supplying water demand.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure, Fire-Suppression Standpipe System Component: Listed for 175-psig minimum working pressure.

B. Delegated Design: Design fire-suppression standpipes, including comprehensive engineering analysis by a qualified professional engineer or NICET Level III, using performance requirements and design criteria indicated.

C. Fire-suppression standpipe design shall be approved by authorities having jurisdiction.

1. Minimum residual pressure at each hose-connection outlet is as follows, or as defined by the authority having jurisdiction:
   a. NPS 2-1/2 Hose Connections: 65 psig.

D. Seismic Performance: Fire-suppression standpipes shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire-suppression standpipes. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For standpipe 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.

D. Coordination Drawings: Fire-suppression standpipes, drawn to scale, on which items installed by other trades are shown and coordinated with each other, using input from installers of the items involved.

E. Qualification Data: For qualified installer and designer.

F. Approved Standpipe Drawings: Working plans, prepared according to NFPA 14, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

G. Welding certificates.

H. Fire-hydrant flow test report.

I. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

J. Field quality-control reports.

K. Operation and Maintenance Data: For fire-suppression standpipes specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing fire-suppression standpipes and providing professional engineering services as needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

    a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Level III.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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. NFPA Standards: Fire-suppression standpipe equipment, specialties, accessories, installation, and testing shall comply with NFPA 14, "Installation of Standpipe and Hose Systems."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Galvanized- and 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 10, Black-Steel Pipe: ASTM A 135 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.

C. Standard-Weight, Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, seamless steel pipe with threaded ends.

D. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.

E. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Cast-Iron Flanges: ASME B16.1, Class 125.

H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

I. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

J. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Corcoran Piping System Co.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Galvanized and 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.
4. 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.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. 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.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. NIBCO INC.
c. Victaulic Company.

2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3: Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Fivalco Inc.
    b. Global Safety Products, Inc.
    c. Milwaukee Valve Company.
    d. Viking Group Inc.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International, Inc.
    b. Fivalco Inc.
    c. Global Safety Products, Inc.
    d. Kennedy Valve; a division of McWane, Inc.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Pratt, Henry Company.
    h. Shurjoint Piping Products.
    i. Tyco Fire & Building Products LP.
    j. Victaulic Company.
    k. Viking Group Inc.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Cast or ductile iron.
5. Style: Lug or wafer.
6. End Connections: Grooved.

E. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Cast Iron Pipe Company.
    b. Anvil International, Inc.
    c. Clow Valve Company; a division of McWane, Inc.
    d. Fire-End & Croker Corporation.
    e. Fire Protection Products, Inc.
    f. Fivalco Inc.
    g. Globe Fire Sprinkler Corporation.
    h. Kennedy Valve; a division of McWane, Inc.
    i. Metraflex, Inc.
    j. Milwaukee Valve Company.
    k. Mueller Co.; Water Products Division.
    l. NIBCO INC.
    m. Potter Roemer.

n. Reliable Automatic Sprinkler Co., Inc.
o. Shurjoint Piping Products.
p. Tyco Fire & Building Products LP.
q. United Brass Works, Inc.
r. Victaulic Company.
s. Viking Group Inc.
t. Watts Water Technologies, Inc.

2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

F. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Milwaukee Valve Company.
b. NIBCO INC.
c. United Brass Works, Inc.
d. Viking Group Inc.
e. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 262.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

G. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Hammond Valve.
e. Milwaukee Valve Company.
f. Mueller Co.; Water Products Division.
g. NIBCO INC.
h. Shurjoint Piping Products.
i. Tyco Fire & Building Products LP.
j. United Brass Works, Inc.
k. Viking Group Inc.
l. Watts Water Technologies, Inc.
m. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

H. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. Fivalco Inc.
   c. Global Safety Products, Inc.
   d. Kennedy Valve; a division of McWane, Inc.
   e. Milwaukee Valve Company.
   f. NIBCO INC.
   g. Shurjoint Piping Products.
   h. Tyco Fire & Building Products LP.
   i. Victaulic Company.
   j. Viking Group Inc.
   k. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig minimum.
4. Valves NPS 2 and Smaller:

   a. Valve Type: Ball or butterfly.
   b. Body Material: Bronze.
   c. End Connections: Threaded.

5. Valves NPS 2-1/2 and Larger:

   a. Valve Type: Butterfly.
   b. Body Material: Cast or ductile iron.
   c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral electrical, 115-V ac, prewired, single- or two-circuit, supervisory switch indicating device.

I. NRS Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Cast Iron Pipe Company.
   b. American Valve, Inc.
   c. Clow Valve Company; a division of McWane, Inc.
   d. Kennedy Valve; a division of McWane, Inc.
   e. Mueller Co.; Water Products Division.
   f. NIBCO INC.
   g. Tyco Fire & Building Products LP.
   h. Viking Group Inc.
   i. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast iron with indicator post flange.
5. Stem: Nonrising.
6. End Connections: Flanged or grooved.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire Protection Products, Inc.
   b. NIBCO INC.
   c. United Brass Works, Inc.
   d. Viking Group Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. Conbraco Industries, Inc.; Apollo Valves.
   c. Fire-End & Croker Corporation.
   d. Fire Protection Products, Inc.
   e. Flowserve.
   f. Jomar International, Ltd.
   g. Kennedy Valve; a division of McWane, Inc.
   h. Legend Valve.
   i. Milwaukee Valve Company.
   j. NIBCO INC.
   k. Potter Roemer.
   l. Tyco Fire & Building Products LP.
   m. Victaulic Company.
   n. Watts Water Technologies, Inc.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire Protection Products, Inc.
   b. NIBCO INC.
   c. United Brass Works, Inc.

E. Plug Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flowserve.
   b. Homestead Valve.

c. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

   a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.

3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Globe Fire Sprinkler Corporation.
   b. Reliable Automatic Sprinkler Co., Inc.
   c. Tyco Fire & Building Products LP.
   d. Victaulic Company.
   e. Viking Group Inc.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Pressure-Reducing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Brass Mfg. Company, Inc.
   b. Fire-End & Croker Corporation.
   c. Fire Protection Products, Inc.
   d. GMR International Equipment Corporation.
   e. Guardian Fire Equipment, Inc.
   f. Potter Roemer.
   g. Tyco Fire & Building Products LP.
   h. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. UL 668 hose valve, with integral UL 1468 reducing device.
3. Pressure Rating: 300 psig minimum.
4. Material: Brass or bronze.
5. Inlet: Female pipe threads.
6. Outlet: Threaded with or without adapter having male hose threads.

7. Pattern: Angle.
8. Finish: Rough brass or bronze.

D. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire Protection Products, Inc.
   b. Guardian Fire Equipment, Inc.
   c. Potter Roemer.
   d. Reliable Automatic Sprinkler Co., Inc.
   e. Tyco Fire & Building Products LP.
   f. Viking Group Inc.

2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 HOSE CONNECTIONS

A. Adjustable-Valve Hose Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Elkhart Brass Mfg. Company, Inc.
   b. Fire-End & Croker Corporation.
   c. Fire Protection Products, Inc.
   d. GMR International Equipment Corporation.
   e. Guardian Fire Equipment, Inc.
   f. Potter Roemer.
   g. Tyco Fire & Building Products LP.
   h. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 668 hose valve, with integral UL 1468 reducing or restricting pressure-control device, for connecting fire hose.
3. Pressure Rating: 300 psig minimum.
4. Material: Brass or bronze.
5. Size: NPS 1-1/2 or NPS 2-1/2, as indicated.
6. Inlet: Female pipe threads.
7. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
8. Pattern: Angle.
9. Pressure-Control Device Type: Pressure reducing or restricting.
10. Finish: Rough brass or bronze.

B. Nonadjustable-Valve Hose Connections:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkhart Brass Mfg. Company, Inc.
b. Fire-End & Croker Corporation.
c. Fire Protection Products, Inc.
d. GMR International Equipment Corporation.
e. Guardian Fire Equipment, Inc.
f. Kennedy Valve; a division of McWane, Inc.
g. Mueller Co.; Water Products Division.
h. NIBCO INC.
i. Potter Roemer.
j. Tyco Fire & Building Products LP.

2. Standard: UL 668 hose valve for connecting fire hose.
3. Pressure Rating: 300 psig minimum.
4. Material: Brass or bronze.
5. Size: NPS 2-1/2
6. Inlet: Female pipe threads.
7. Outlet: Male hose threads with lugged cap, gasket, and chain. Include hose valve threads according to NFPA 1963 and matching local fire-department threads.
8. Pattern: Angle.
9. Finish: Rough brass or bronze.

2.8 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell company.
b. Fire Protection Products, Inc.
c. GMR International Equipment Corporation.
d. Notifier; a Honeywell company.
e. Potter Electric Signal Company.
f. Potter Roemer.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 10-inch diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ADT Security Services, Inc.
b. McDonnell & Miller; ITT Industries.
c. Potter Electric Signal Company.
d. Potter Roemer.
e. System Sensor; a Honeywell company.
f. Viking Group Inc.

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.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Barksdale, Inc.
   b. Detroit Switch, Inc.
   c. Potter Electric Signal Company.
   d. System Sensor; a Honeywell company.
   e. Tyco Fire & Building Products LP.
   f. United Electric Controls Co.
   g. Viking Group Inc.

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.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell company.
   b. Kennedy Valve; a division of McWane, Inc.
   c. Potter Electric Signal Company.
   d. Potter Roemer.
   e. System Sensor; a Honeywell company.

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.

2.9 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK; U.S. Gauge Division.
2. Ashcroft Inc.
3. Brecco Corporation.
4. Fire Protection Products, Inc.

5. Potter Roemer.
6. Weiss Instruments, Inc.
7. WIKA Instrument Corporation.
8. Winters Instruments - U.S.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 300 psig.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 14 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 EXAMINATION

A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.

B. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 SERVICE-ENTRANCE PIPING

A. Connect fire-suppression standpipe piping to water-service piping at service entrance into building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-Suppression Water-Service Piping."

B. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.4 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

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.

B. Piping Standard: Comply with requirements in NFPA 14 for installation of fire-suppression standpipe piping.

C. Install seismic restraints on piping. Comply with requirements in NFPA 13 for seismic-restraint device materials and installation.

D. Install listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install drain valves on standpipes. Extend drain piping to outside of building.

F. Install automatic (ball drip) drain valves to drain piping between fire-department connections and check valves. Drain to floor drain or outside building.

G. Install alarm devices in piping systems.

H. Install hangers and supports for standpipe system piping according to NFPA 14. Comply with requirements in NFPA 13 for hanger materials.

I. Install pressure gages on riser or feed main 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 will not be subject to freezing.

J. Fill wet-type standpipe system piping with water.

K. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

L. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

M. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 21 Section "Escutcheons 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. 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.

I. 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.

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. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.6 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 14 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. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Install bypass check valve and retarding chamber drain-line connection.

3.7 HOSE-CONNECTION INSTALLATION

A. Install hose connections adjacent to standpipes.

B. Install freestanding hose connections for access and minimum passage restriction.

C. Install NPS 2-1/2 hose connections with quick-disconnect NPS 2-1/2 by NPS 1-1/2 reducer adapter and flow-restricting device.

D. Install wall-mounted-type hose connections in cabinets. Include pipe escutcheons, with finish matching valves, inside cabinet where water-supply piping penetrates cabinet. Install valves at angle required for connection of fire hose. Comply with requirements for cabinets in Division 10 Section "Fire Extinguisher Cabinets."

3.8 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 14.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

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 standpipe systems according to NFPA 14, "System Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Start and run air compressors.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Fire-suppression standpipe system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.11 PIPING SCHEDULE

A. Standard-pressure, wet-type, fire-suppression standpipe piping, 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.
4. 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.
5. Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.

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. Fire-protection valves.
3. Sprinklers.
4. Alarm devices.
5. Pressure gages.

B. Related Sections:

1. Division 21 Section "Fire-Suppression Standpipes" for standpipe piping.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer or NICET Level III, using performance requirements and design criteria indicated.

1. Available fire-hydrant flow test records indicate the following conditions:

a. Date: 02-07-18.
b. Time: 10:32 a.m.
c. Performed by: Cody Knox of Brunswick County Public Utilities.
d. Location of Residual Fire Hydrant R: Hydrant B number 4211.
e. Location of Flow Fire Hydrant F: Hydrant A number 4212.
f. Static Pressure at Residual Fire Hydrant R: 72 psig.
g. Measured Flow at Flow Fire Hydrant F: 1115 gpm.
h. Residual Pressure at Residual Fire Hydrant R: 60 psig.

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:
   a. Building Service Areas: Ordinary Hazard, Group 1.
   b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
   c. General Storage Areas: Ordinary Hazard, Group 1.
   d. Laundries: Ordinary Hazard, Group 1.
   e. Libraries except Stack Areas: Light Hazard.
   f. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
   g. Classroom, Office and Public Areas: Light Hazard.

3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.

4. Maximum Protection Area per Sprinkler: Per UL listing.
5. Maximum Protection Area per Sprinkler:
   a. Office Spaces: 225 sq. ft.
   b. Storage Areas: 130 sq. ft.
   c. Mechanical Equipment Rooms: 130 sq. ft.
   d. Electrical Equipment Rooms: 130 sq. ft.
   e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

   a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
   b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the NICET Level III designer, responsible for their preparation.

D. Coordination Drawings: Sprinkler systems, drawn to scale, on which items installed by other trades are shown and coordinated with each other, using input from installers of the items involved.

E. Qualification Data: For qualified installer and designer.

F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

G. Welding certificates.

H. Fire-hydrant flow test report.

I. Field Test Reports and Certificates: 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."

J. Field quality-control reports.

K. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

    a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by the NICET Level III designer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. 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.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Galvanized- and 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 10, Black-Steel Pipe: ASTM A 135 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.

C. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

D. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.

E. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

F. Malleable- or Ductile-Iron Unions: UL 860.

G. Cast-Iron Flanges: ASME 16.1, Class 125.

H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

I. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

J. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Corcoran Piping System Co.
c. National Fittings, Inc.
d. Shurjoint Piping Products.
e. Tyco Fire & Building Products LP.
f. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Galvanized and 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.
4. 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.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, non-metallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. 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.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. NIBCO INC.
c. Victaulic Company.

2. Standard: UL 1091 except with ball instead of disc.
3. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
4. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
5. Valves NPS 3: Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.
b. Global Safety Products, Inc.
c. Milwaukee Valve Company.

d. Viking Group Inc.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Fivalco Inc.
c. Global Safety Products, Inc.
d. Kennedy Valve; a division of McWane, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Pratt, Henry Company.
h. Shurjoint Piping Products.
i. Tyco Fire & Building Products LP.
j. Victaulic Company.
k. Viking Group Inc.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig.
4. Body Material: Cast or ductile iron.
5. Style: Lug or wafer.
6. End Connections: Grooved.

E. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company.
b. Anvil International, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Fire-End & Croker Corporation.
e. Fire Protection Products, Inc.
f. Fivalco Inc.
g. Globe Fire Sprinkler Corporation.
h. Kennedy Valve; a division of McWane, Inc.
i. Metraflex, Inc.
j. Milwaukee Valve Company.
k. Mueller Co.; Water Products Division.
l. NIBCO INC.
m. Potter Roemer.
n. Reliable Automatic Sprinkler Co., Inc.
o. Shurjoint Piping Products.
p. Tyco Fire & Building Products LP.
q. United Brass Works, Inc.
r. Victaulic Company.
s. Viking Group Inc.
t. Watts Water Technologies, Inc.

2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

F. Bronze OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Milwaukee Valve Company.
   b. NIBCO INC.
   c. United Brass Works, Inc.
   d. Viking Group Inc.
   e. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 262.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

G. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Cast Iron Pipe Company.
   b. American Valve, Inc.
   c. Clow Valve Company; a division of McWane, Inc.
   d. Hammond Valve.
   e. Milwaukee Valve Company.
   f. Mueller Co.; Water Products Division.
   g. NIBCO INC.
   h. Shurjoint Piping Products.
   i. Tyco Fire & Building Products LP.
   j. United Brass Works, Inc.
   k. Viking Group Inc.
   l. Watts Water Technologies, Inc.
   m. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

H. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International, Inc.
   b. Fivalco Inc.
   c. Global Safety Products, Inc.
   d. Kennedy Valve; a division of McWane, Inc.

e. Milwaukee Valve Company.
f. NIBCO INC.
g. Shurjoint Piping Products.
h. Tyco Fire & Building Products LP.
i. Victaulic Company.
j. Viking Group Inc.
k. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig minimum.
4. Valves NPS 2 and Smaller:

a. Valve Type: Ball or butterfly.
b. Body Material: Bronze.
c. End Connections: Threaded.

5. Valves NPS 2-1/2 and Larger:

a. Valve Type: Butterfly.
b. Body Material: Cast or ductile iron.
c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral electrical, 115-V ac, prewired, single- or two-circuit, supervisory switch indicating device.

I. NRS Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Kennedy Valve; a division of McWane, Inc.
e. Mueller Co.; Water Products Division.
f. NIBCO INC.
g. Tyco Fire & Building Products LP.
h. Viking Group Inc.
i. Zurn Plumbing Products Group; Wilkins Water Control Products Division.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast iron with indicator post flange.
5. Stem: Nonrising.
6. End Connections: Flanged or grooved.

J. Indicator Posts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Kennedy Valve; a division of McWane, Inc.

e. Mueller Co.; Water Products Division.
f. NIBCO INC.
g. Tyco Fire & Building Products LP.
h. Viking Group Inc.

2. Standard: UL 789.
3. Type: Horizontal for wall mounting.
4. Body Material: Cast iron with extension rod and locking device.
5. Operation: Wrench or hand wheel.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Protection Products, Inc.
b. NIBCO INC.
c. United Brass Works, Inc.
d. Viking Group Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Fire-End & Croker Corporation.
d. Fire Protection Products, Inc.
e. Flowserve.
f. Jomar International, Ltd.
g. Kennedy Valve; a division of McWane, Inc.
h. Legend Valve.
i. Milwaukee Valve Company.
j. NIBCO INC.
k. Potter Roemer.
l. Tyco Fire & Building Products LP.
m. Victaulic Company.
n. Watts Water Technologies, Inc.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Protection Products, Inc.

b. NIBCO INC.
c. United Brass Works, Inc.

E. Plug Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flowserve.
b. Homestead Valve.
c. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating:

a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.

3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Globe Fire Sprinkler Corporation.
b. Reliable Automatic Sprinkler Co., Inc.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.
e. Viking Group Inc.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

2.7 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. National Fittings, Inc.

c. Shurjoint Piping Products.
d. Tyco Fire & Building Products LP.
e. Victaulic Company.

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-T 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: Subject to compliance with requirements, provide products by one of the following:

a. AGF Manufacturing Inc.
b. Reliable Automatic Sprinkler Co., Inc.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
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.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkhart Brass Mfg. Company, Inc.
b. Fire-End & Croker Corporation.
c. Potter Roemer.

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: Subject to compliance with requirements, provide products by one of the following:

a. AGF Manufacturing Inc.
b. Triple R Specialty.

c. Tyco Fire & Building Products LP.
d. Victaulic Company.
e. Viking Group Inc.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
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: Subject to compliance with requirements, provide products by one of the following:

a. CECA, LLC.
b. Corcoran Piping System Co.
c. Merit Manufacturing; a division of Anvil International, Inc.

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: Subject to compliance with requirements, provide products by one of the following:

a. Fivalco Inc.
b. FlexHead Industries, Inc.
c. Gateway Tubing, Inc.

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: Subject to compliance with requirements, provide products by one of the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc.
3. Tyco Fire & Building Products LP.
4. Victaulic Company.
5. Viking Group Inc.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Residential Sprinklers: 175 psig maximum.
3. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
4. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:
1. Nonresidential Applications: UL 199.
2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Polyester coated.
4. Stainless steel.

E. Special Coatings:

1. Wax.
2. Lead.
3. Electroless Nickel PTFE.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications unless otherwise indicated. 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.

G. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Globe Fire Sprinkler Corporation.
b. Reliable Automatic Sprinkler Co., Inc.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.
e. Viking Group Inc.

2. Standard: UL 199.
3. 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. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell company.
b. Fire Protection Products, Inc.
c. GMR International Equipment Corporation.
d. Notifier; a Honeywell company.
e. Potter Electric Signal Company.
f. Potter Roemer.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 10-inch diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ADT Security Services, Inc.
b. McDonnell & Miller; ITT Industries.
c. Potter Electric Signal Company.
d. Potter Roemer.
e. System Sensor; a Honeywell company.
f. Viking Group Inc.

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.

D. Pressure Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Barksdale, Inc.
b. Detroit Switch, Inc.
c. Potter Electric Signal Company.
d. System Sensor; a Honeywell company.
e. Tyco Fire & Building Products LP.
f. United Electric Controls Co.
g. Viking Group Inc.

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.

E. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Fire-Lite Alarms, Inc.; a Honeywell company.
    b. Kennedy Valve; a division of McWane, Inc.
    c. Potter Electric Signal Company.
    d. Potter Roemer.
    e. System Sensor; a Honeywell company.

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.

F. Indicator-Post Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Potter Electric Signal Company.
    b. Potter Roemer.
    c. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.10 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. Fire Protection Products, Inc.
5. Potter Roemer.
6. Weiss Instruments, Inc.
7. WIKA Instrument Corporation.
8. Winters Instruments – U.S.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 300 psig.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/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 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

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.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

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 alarm devices in piping systems.

K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

L. 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 will not be subject to freezing.

M. Fill sprinkler system piping with water.

N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 21 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 21 Section "Escutcheons 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 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. 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.

I. 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.

J. 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.

K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 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. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.6 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 Division 26 Section "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

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. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves and pressure-maintenance pumps.

3.10 PIPING SCHEDULE

A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

B. Standard-pressure, wet-pipe sprinkler system piping, 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.
4. 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.
5. Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers. The Gymnasium shall require the installation of wire cages for all sprinklers installed.
2. Rooms with Suspended Ceilings: Concealed sprinklers with white cover plate.
3. Wall Mounting: Sidewall sprinklers.
4. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where permitted.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted cover plate.
2. Flush Sprinklers: Bright chrome, or polyester coated.
3. Recessed Sprinklers: Bright chrome, or polyester coated.
4. Upright, Pendent and Sidewall Sprinklers: Chrome plated, or polyester coated, in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; corrosion resistant finishes where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

SECTION 21 32 16

DIESEL-DRIVE, VERTICAL-TURBINE FIRE PUMPS

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. Vertical-turbine fire pumps.
2. Fire-pump accessories and specialties.
3. Flowmeter systems.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire pumps shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For fire pumps, right-angle gear drives, engine drivers, and fire-pump accessories and specialties. 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. Seismic Qualification Certificates: For fire pumps, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Certificates: For each fire pump, from manufacturer.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire pumps to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for location and application.

B. NFPA Compliance: Comply with NFPA 20, "Installation of Stationary Pumps for Fire Protection."

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VERTICAL-TURBINE FIRE PUMPS

A. Description: Factory-assembled and -tested fire pump, right-angle gear drive, and driver.

B. Base: Fabricated and attached to fire pump, right-angle gear drive, and driver with reinforcement to resist movement of pump, gear drive, and driver during seismic events when base is anchored to building substrate.

C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.

2.2 VERTICAL-TURBINE FIRE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A-C Fire Pump Systems; a Xylem brand.
2. Patterson Pump Company; a subsidiary of the Gorman-Rupp Company.
3. Peerless Pump, Inc.
4. Pentair Pump Group; Aurora Pump.
5. Reddy-Buffaloes Pump Company.

6. S.A. Armstrong Limited.

B. Pump Head: Cast iron, for surface discharge.

1. Discharge Outlet: With flange according to ASME B16.1 except connections may be threaded according to ASME B1.20.1, in sizes where flanges are not available.
2. Pump Head Seal: Stuffing box and packing.
3. Base: Cast iron or steel with hole for electrical cable.

C. Pump:

1. Standard: UL 448, for vertical-turbine pumps for fire service.
2. Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves.
3. Line Shaft Bearings: Rubber sleeve, water lubricated.
4. Line Shaft: Steel.
5. Line Shaft Bearings: Corrosion resistant, oil lubricated.
6. Impeller Shaft: Monel metal or stainless steel.
7. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
8. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet or less.
9. Suction Strainer: Cast or fabricated, bronze or stainless steel, and sized to restrict passage of 0.5-inch spheres.

D. Right-Angle Gear Drive:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amarillo Gear Co.
b. De'Ran Gear, Inc.
c. Johnson Gear Co. LLC.
d. Randolph Gear, Inc.

2. Description: FM-Approved, speed-reduction gear drive for pump speed control. Provide ratio for outlet speed of approximately 1760 rpm.

E. Engine-to-Gear Drive Shaft: FM-Approved, telescoping, steel drive shaft with universal joint and grease fitting at each end. Include metal shaft guard.

F. Driver:

1. Standard: UL 1247.
2. Type: Diesel engine.
3. Emergency Manual Operator: Factory wired for starting and operating standby engine in case of malfunction in main controller or wiring.
4. Engine Cooling System: Factory-installed radiator.

a. Coolant: Type recommended by driver manufacturer.

5. Engine Cooling System: Factory-installed water piping, valves, strainer, pressure regulator, heat exchanger, coolant pump, bypass piping, and fittings.

a. Piping: ASTM B 88, Type L, copper water tube; ASME B16.22, wrought-copper, solder-joint pressure fittings; AWS A5.8/A5.8M, BCuP Series brazing filler metal; and brazed joints.

6. Engine-Jacket Water Heater: Factory-installed electric elements.
7. Dual Batteries: Lead-acid-storage type with 100 percent standby reserve capacity.
8. Fuel System: According to NFPA 20.

a. Fuel Storage Tank: Size indicated but not less than required by NFPA 20. Include floor legs, direct-reading level gage, and secondary containment tank with capacity at least equal to fuel storage tank.

9. Exhaust System: ASTM A 53/A 53M, Type E or S, Schedule 40, black steel pipe; ASME B16.9, weld-type pipe fittings; ASME B16.5, steel flanges; and ASME B16.21, nonmetallic gaskets. Fabricate double-wall, ventilated thimble from steel pipe.

a. Exhaust Connector: Flexible type.
b. Exhaust Silencer: **Industrial** type.

G. Capacities and Characteristics:

1. Rated Capacity: Per NICET Level III delegated design.
2. Total Rated Head: Per delegated design.
3. Inlet Column Size: Per delegated design.
4. Pump Column Length: Per delegated design.
5. Pump Head Outlet Flange: Per delegated design.
6. Suction Head Available at Pump: Per delegated design.
7. Engine Horsepower: Per delegated design.
8. Engine Speed: Per delegated design.
9. Fuel Tank Capacity: Per delegated design.
10. Pump-Start, Pressure-Switch Setting: Per delegated design.
11. Pump-Stop, Pressure-Switch Setting: Per delegated design.

2.3 FIRE-PUMP ACCESSORIES AND SPECIALTIES

A. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump discharge piping.

B. Relief Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BERMAD Control Valves.
b. CLA-VAL Automatic Control Valves.
c. Kunkle Valve; a part of Tyco International Ltd.
d. OCV Control Valves.
e. Watts Regulator Company; a division of Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description: UL 1478, bronze or cast iron, spring loaded; for installation in fire-suppression water-supply piping.

C. Outlet Fitting: Concentric tapered reducer at pump-head discharge outlet.

D. Discharge Cone: Closed or open type.

E. Hose Valve Manifold Assembly:

1. Standard: Comply with requirements in NFPA 20.
2. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1.
3. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings.
4. Automatic Drain Valve: UL 1726.
5. Manifold:

    a. Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
    b. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20.
    c. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
    d. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
    e. Escutcheon Plate: Brass or bronze; rectangular.
    f. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads.
    g. Exposed Parts Finish: Polished, chrome plated.
    h. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

6. Manifold:

    a. Test Connections: Comply with UL 405 except provide outlets without clappers instead of inlets.
    b. Body: Exposed type, brass, with number of outlets required by NFPA 20.
    c. Escutcheon Plate: Brass or bronze; round.
    d. Hose Valves: UL 668, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains.
    e. Exposed Parts Finish: Polished, chrome plated.
    f. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

2.4 FLOWMETER SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Emerson Process Management; Rosemount Division.
2. Fire Research Corp.
3. Gerand Engineering Co.
4. Hydro Flow Products, Inc.
5. Hyspan Precision Products, Inc.
6. Meriam Process Technologies.
7. Preso Meters; Division of Racine Federated Inc.
8. Reddy-Buffaloes Pump Company.
9. Victaulic Company.

B. Description: UL-listed or FM-Approved, fire-pump flowmeter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity.

C. Pressure Rating: 175 psig minimum.

D. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flowmeter, and fittings.

E. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches in diameter. Include bracket or device for wall mounting.

1. Tubing Package: NPS 1/8 or NPS 1/4 soft copper tubing with copper or brass fittings and valves.

F. Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches in diameter and with two 12-foot-long hoses in carrying case.

2.5 GROUT

A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire pumps according to UL 448 requirements for "Operation Test" and "Manufacturing and Production Tests."

1. Verification of Performance: Rate fire pumps according to UL 448.

B. Fire pumps will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of fire pumps.

B. Examine roughing-in for fire-suppression piping systems to verify actual locations of piping connections before fire-pump installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fire-Pump Installation Standard: Comply with NFPA 20 for installation of fire pumps, relief valves, and related components.

B. Equipment Mounting: Install fire pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section.

1. 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.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
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.

C. Install fire-pump discharge piping equal to or larger than size required by NFPA 20.

D. Support piping and pumps separately so weight of piping does not rest on pumps.

E. Install valves that are same size as connecting piping. Comply with requirements for fire-protection valves specified in Division 21 Section "Fire-Suppression Standpipes."Division 21 Section "Wet-Pipe Sprinkler Systems."

F. Install pressure gage on pump head discharge flange pressure-gage tapping. Comply with requirements for pressure gages specified in Division 21 Section "Fire-Suppression Standpipes." Division 21 Section "Wet-Pipe Sprinkler Systems."

G. Install piping hangers and supports, anchors, valves, gages, and equipment supports according to NFPA 20.

H. Install fuel system according to NFPA 20.

I. Install water supply and drain piping for diesel-engine heat exchangers. Extend drain piping from heat exchangers to point of disposal.

J. Install exhaust system piping for diesel engines. Extend to point of termination outside structure. Install pipe and fittings with welded joints; install components having flanged connections with gasketed joints.

K. Install condensate drain piping for diesel-engine exhaust system. Extend drain piping from low points of exhaust system to condensate traps and to point of disposal.

L. Install flowmeters and sensors. Install flowmeter-system components and make connections according to NFPA 20 and manufacturer's written instructions.

M. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not factory mounted. Furnish copies of manufacturers' wiring diagram submittals to electrical Installer.

N. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

3.3 ALIGNMENT

A. Align fire-pump-driver, right-angle gear-drive, and fire-pump shafts after complete unit has been leveled on concrete base, grout has set, and anchor bolts have been tightened.

B. After alignment is correct, tighten anchor bolts evenly. Fill baseplate completely with grout, with metal blocks and shims or wedges in place. Tighten anchor bolts after grout has hardened. Check alignment and make required corrections.

C. Align piping connections.

D. Align pump and driver shafts for angular and parallel alignment according to HI 2.4 and to tolerances specified by manufacturer.

3.4 CONNECTIONS

A. Comply with requirements for piping and valves specified in Division 21 Section "Fire-Suppression Standpipes." Division 21 Section "Wet-Pipe Sprinkler Systems." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps and equipment to allow service and maintenance.

C. Connect relief-valve discharge to drainage piping or point of discharge.

D. Connect flowmeter-system meters, sensors, and valves to tubing.

E. Connect fire pumps to their controllers.

3.5 IDENTIFICATION

A. Identify system components. Comply with requirements for fire-pump marking according to NFPA 20.

3.6 FIELD QUALITY CONTROL

A. Test each fire pump with its right-angle gear drive and controller as a unit. Comply with requirements for electric-motor-driver fire-pump controllers specified in Division 21 Section "Controllers for Fire-Pump Drivers."

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

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. After installing components, assemblies, and equipment including controller, test for compliance with requirements.

2. Test according to NFPA 20 for acceptance and performance testing.
3. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
4. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Components, assemblies, and equipment will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

G. Furnish fire hoses in number, size, and length required to reach storm drain or other acceptable location to dispose of fire-pump test water. Hoses are for tests only and do not convey to Owner.

3.7 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.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire pumps, right-angle gear drives, and fire-pump controllers.

END OF SECTION

SECTION 21 34 00

PRESSURE-MAINTENANCE PUMPS

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. Multistage, pressure-maintenance pumps.
2. Vertical-turbine, pressure-maintenance pumps.

B. Related Section:

1. Division 21 Section "Controllers For Fire-Pump Drivers" for pressure-maintenance-pump controllers.

1.3 PERFORMANCE REQUIREMENTS

A. Pump Equipment, Accessory, and Specialty Pressure Rating: 175 psig minimum unless higher pressure rating is indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, performance curves, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For pumps, accessories, and specialties. 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. Field quality-control reports.

D. Operation and Maintenance Data: For pumps to include in operation and maintenance manuals.

1.5 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.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 MULTISTAGE, PRESSURE-MAINTENANCE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A-C Fire Pump Systems; a business of ITT Industries.
2. Grundfos Management A/S; Grundfos Pumps Corporation U.S.A.
3. PACO Pumps; Grundfos Pumps Corporation U.S.A.
4. TACO Incorporated.

B. Description: Factory-assembled and -tested, multistage, barrel-type vertical pump as defined in HI 2.1-2.2 and HI 2.3; designed for surface installation with pump and motor direct coupled and mounted vertically.

C. Pump Construction:

1. Barrel: Stainless steel.
2. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
3. Pump Head/Motor Mount: Cast iron.
4. Impellers: Stainless steel, balanced, and keyed to shaft.
5. Pump Shaft: Stainless steel.
6. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
7. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
8. Chamber-Base Bearing: Tungsten carbide.
9. O-Rings: EPDM or NBR.

D. Motor: Single speed with permanently lubricated ball bearings and rigidly mounted to pump head. Comply with requirements in Division 21 Section "Common Motor Requirements for Fire Suppression Equipment."

1. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet long.

E. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

F. Capacities and Characteristics:

1. Rated Capacity: Per delegated NICET III design.
2. Total Dynamic Head: Per delegated design.
3. Working Pressure: 175-psig minimum.
4. Inlet and Outlet Size: NPS 1-1/4.

5. Discharge and Suction Flanges: Class 250.
6. Suction Head Available at Pump: Per delegated design.
7. Motor Horsepower: Per delegated design.
8. Motor Speed: Per delegated design.
9. Electrical Characteristics:

    a. Volts: 120V.
    b. Phases: Single.
    c. Hertz: 60.
    d. Full-Load Amperes: Per delegated design.
    e. Minimum Circuit Ampacity: Per delegated design.
    f. Maximum Overcurrent Protection: Per delegated.

10. Pump-Start, Pressure-Switch Setting: Per delegated design.
11. Pump-Stop, Pressure-Switch Setting: Per delegated design.

2.2 VERTICAL-TURBINE, PRESSURE-MAINTENANCE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. A-C Fire Pump Systems; a Xylem brand.
2. Patterson Pump Company; a subsidiary of the Gorman-Rupp Company.
3. Peerless Pump, Inc.
4. Pentair Pump Group; Aurora Pump.
5. Reddy-Buffaloes Pump Company.
6. S.A. Armstrong Limited.

B. Description: Factory-assembled and -tested, vertical, multistage, open-line-shaft turbine pump as defined in HI 2.1-2.2 and HI 2.3; with pump motor mounted above pump head.

C. Pump Construction:

1. Pump Head: Cast iron, for surface discharge, with flange except connections may be threaded in sizes in which flanges are not available.
2. Pump Head Seal: Stuffing box and stuffing.
3. Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves.
4. Line Shaft Bearings: Rubber sleeve, water lubricated.
5. Line Shaft: Steel.
6. Line Shaft Bearings: Corrosion resistant, oil lubricated.
7. Impeller Shaft: Monel metal or stainless steel.
8. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
9. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet or less, with strainer of cast or fabricated bronze or stainless steel at bottom.

D. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Division 21 Section "Common Motor Requirements for Fire Suppression Equipment."

1. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet long.

E. Base: Cast iron or steel with hole for electrical cable.

F. Nameplate: Permanently attached to pump and indicating capacity and characteristics.

G. Capacities and Characteristics:

1. Rated Capacity: Per NICET III delegated design.
2. Total Dynamic Head: Per delegated design.
3. Working Pressure: Per delegated design.
4. Inlet Column Size: Per delegated design.
5. Pump Column Length: Per delegated design.
6. Outlet Size: Per delegated design.
7. Flange: Class 125.
8. Suction Head Available at Pump: Per delegated design.
9. Motor Horsepower: Per delegated design.
10. Motor Speed: Per delegated design.
11. Electrical Characteristics:

    a. Volts: 120V.
    b. Phases: Single.
    c. Hertz: 60.
    d. Full-Load Amperes: Per delegated design.
    e. Minimum Circuit Ampacity: Per delegated design.
    f. Maximum Overcurrent Protection: Per delegated design.

12. Pump-Start, Pressure-Switch Setting: Per delegated design.
13. Pump-Stop, Pressure-Switch Setting: Per delegated design.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 21 Section "Common Motor Requirements for Fire Suppression 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. Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. NFPA Standard: Comply with NFPA 20 for installation of pressure-maintenance pumps.

B. Base-Mounted Pump Mounting: Install pumps on concrete bases. Comply with requirements for concrete bases specified in Division 03 Section.

1. 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.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

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. Attach pumps to equipment base using anchor bolts.

C. Install multistage, pressure-maintenance pumps according to HI 1.4.

D. Install vertical-turbine, pressure-maintenance pumps according to HI 2.4.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Pressure-maintenance pumps will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.3 ADJUSTING

A. Lubricate pumps as recommended by manufacturer.

B. Set field-adjustable pressure-switch ranges as indicated.

END OF SECTION

SECTION 21 39 00

CONTROLLERS FOR FIRE-PUMP DRIVERS

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. Full-service, full-voltage controllers rated 600 V and less.
2. Limited-service controllers rated 600 V and less.
3. Controllers for diesel-drive fire pumps.
4. Controllers for pressure-maintenance pumps.
5. Remote alarm panels.
6. Low-suction-shutdown panels.

1.3 DEFINITIONS

A. ATS: Automatic transfer switch(es).

B. ECM: Electronic control module.

C. MCCB: Molded-case circuit breaker.

D. N.O.: Normally open.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-pump controllers and alarm panels shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories**.**

B. Shop Drawings: For each type of product indicated. Include dimensioned plans, elevations, sections, details, and attachments to other work, including required clearances and service spaces around controller enclosures.

1. Show tabulations of the following:

a. Each installed unit's type and details.
b. Enclosure types and details for types other than NEMA 250, Type 2.
c. Factory-installed devices.
d. Nameplate legends.
e. Short-circuit current (withstand) rating of integrated unit.
f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices.
g. Specified modifications.

2. Detail equipment assemblies and indicate dimensions, weights, loads, method of field assembly, components, and location and size of each field connection.
3. Schematic and Connection Diagrams: For power, signal, alarm, and control wiring and for pressure-sensing tubing.

C. Qualification Data: For qualified testing agency.

D. Seismic Qualification Certificates: For each type of product indicated, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Product Certificates: For each type of product indicated, from manufacturer.

F. Manufacturer's factory test reports of fully assembled and tested equipment.

G. Source quality-control reports.

H. Field quality-control reports.

I. Operation and Maintenance Data: For each type of product indicated to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
2. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor-based logic controls.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of an NRTL.

B. Source Limitations: Obtain fire-pump controllers and all associated equipment from single source or producer.

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 standards of authorities having jurisdiction pertaining to materials and installation.

E. Comply with NFPA 20 and NFPA 70.

F. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, protect controllers from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; connect factory-installed space heaters to temporary electrical service.

1.8 PROJECT CONDITIONS

A. Environmental Limitations:

1. Ambient Temperature Rating: Not less than 40 deg F and not exceeding 122 deg F unless otherwise indicated.
2. Altitude Rating: Not exceeding 6600 feet unless otherwise indicated.

1.9 COORDINATION

A. Coordinate layout and installation of controllers with other construction including conduit, piping, fire-pump equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels. Ensure that controllers are within sight of fire-pump drivers.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.10 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Indicating Lights: Two of each type and color of lens installed; two of each type and size of lamp installed.
2. Auxiliary Contacts: One for each size and type of magnetic contactor installed.
3. Power Contacts: Three for each size and type of magnetic contactor installed.
4. Contactor Coils: One for each size and type of magnetic controller installed.
5. Relay Boards: One for each size and type of relay board installed.
6. Operator Interface: One microprocessor board(s), complete with display and membrane keypad.

PART 2 - PRODUCTS

2.1 CONTROLLERS FOR DIESEL-DRIVE FIRE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aquarius Fluid Products, Inc.
2. ASCO Power Technologies, LP; Firetrol Products.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Hubbell Incorporated; Hubbell Industrial Controls.
5. Joslyn Clark Corporation.
6. Master Control Systems, Inc.
7. Metron, Inc.
8. Tornatech.

B. General Requirements for Controllers:

1. Comply with NFPA 20 and UL 218.
2. Listed by an NRTL for diesel-engine driver for fire-pump service.
3. Combined automatic and nonautomatic operation.
4. Factory assembled, wired, and tested.

C. Method of Starting:

1. Pressure-switch actuated.

    a. Water-pressure-actuated switch and pressure transducer with independent high- and low-calibrated adjustments responsive to water pressure in fire-suppression piping.
    b. System pressure recorder, electric ac driven, with spring backup.
    c. Programmable minimum-run-time relay to prevent short cycling.
    d. Programmable timer for weekly tests.

2. Dual, redundant dc-voltage battery units, with automatic changeover.
3. Emergency Control: Bypasses all automatic control circuits during manual starting and running.
4. Automatic engine start on loss of ac power to the controller.

D. Method of Stopping: Automatic and nonautomatic shutdown after automatic starting.

E. Door-Mounted Operator Interface and Controls:

1. Monitor, display, and control devices, alarms, functions, and operations listed in NFPA 20 as required for drivers and controller types used.
2. Method of Control and Indication:

    a. Microprocessor-based logic controller, with multiline LCD readout.
    b. Membrane keypad.
    c. LED alarm and status indicating lights.

3. Local and Remote Alarm and Status Indications:

    a. Controller power on.

b. Engine-lubrication-system critically low oil pressure.
c. Engine-jacket coolant high temperature.
d. Engine fail-to-start.
e. Engine overspeed shutdown.
f. Low fuel level.
g. Missing or failed battery.
h. Battery charger failure.
i. System overpressure.
j. ECM selector switch in alternate ECM position.
k. Fuel injector malfunction.

4. Audible alarm.
5. Nonautomatic START and STOP push buttons or switches.

F. Optional Features:

1. Extra Output Contacts:

a. One Form C contacts for low pump-room temperature.
b. One each, Form C contacts for high and low fuel levels.
c. One each, Form C contacts for high and low reservoir levels.

2. Door-mounted thermal or impact printer for alarm and status logs.
3. Operator Interface Communications Ports: USB, Ethernet, and RS485.
4. Powered louver contacts.
5. Powered engine-oil heater contacts.

G. Battery Charger System:

1. Built-in, independent, dual battery chargers with automatic changeover; 12-V dc for lead-acid batteries.
2. Standard: UL 1236.

2.2 CONTROLLERS FOR PRESSURE-MAINTENANCE PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aquarius Fluid Products, Inc.
2. ASCO Power Technologies, LP; Firetrol Products.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Hubbell Incorporated; Hubbell Industrial Controls.
5. Joslyn Clark Corporation.
6. Master Control Systems, Inc.
7. Metron, Inc.
8. Tornatech.

B. General Requirements for Pressure-Maintenance-Pump Controllers:

1. Type: UL 508 factory assembled, -wired, and tested, across-the-line; for combined automatic and manual operation.
2. Enclosure: UL 508 and NEMA 250, Type 2 for wall-mounting.
3. Factory assembled, wired, and tested.
4. Finish: Manufacturer's standard color paint.

C. Rate controller for scheduled horsepower and include the following:

1. Fusible disconnect switch.
2. Pressure switch.
3. Hand-off-auto selector switch.
4. Pilot light.
5. Running period timer.

2.3 REMOTE ALARM PANELS

A. General Requirements for Remote Alarm Panels: Comply with NFPA 20 and UL 218; listed by an NRTL for fire-pump service.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aquarius Fluid Products, Inc.
2. ASCO Power Technologies, LP; Firetrol Products.
3. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
4. Hubbell Incorporated; Hubbell Industrial Controls.
5. Joslyn Clark Corporation.
6. Master Control Systems, Inc.
7. Metron, Inc.
8. Tornatech.

C. General Requirements for Remote Alarm Panels: Factory assembled, wired, and tested.

D. Supervisory and Normal Control Voltage: 120-V ac dual source.

E. Audible and Visual Alarm and Status Indications:

1. Driver running.
2. Loss of phase.
3. Phase reversal.
4. Supervised power on.
5. Separate trouble on the controller.
6. Controller connected to alternate power source.

F. Audible and Visual Alarm and Status Indications: Manufacturer's standard indicating lights; push-to-test.

1. Engine running.
2. Controller main switch turned to the off or manual position.
3. Supervised power on.
4. Separate trouble on the controller or engine.
5. Common pump room trouble.
6. Controller connected to alternate power source.

G. Audible alarm, with silence push button.

H. Pump REMOTE START push button.

2.4 LOW-SUCTION-SHUTDOWN PANELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aquarius Fluid Products, Inc.
2. ASCO Power Technologies, LP; Firetrol Products.
3. Hubbell Incorporated; Hubbell Industrial Controls.
4. Joslyn Clark Corporation.
5. Master Control Systems, Inc.
6. Metron, Inc.
7. Tornatech.

B. General Requirements for Low-Suction-Shutdown Panels:

1. Listed by an NRTL for fire-pump service.
2. Factory assembled, wired, and tested.
3. Prevents automatic start of fire pump, and shuts down automatically started fire pump, on low-suction pressure.
4. Automatic reset.

C. Operation: External contact input.

D. Supervisory and Normal Control Voltage: 120-V ac; dual source.

E. Include audible and visual alarms and status indications, with silence push button, for the following conditions:

1. Control power available.
2. Low-suction pressure.
3. Normal-suction pressure.

2.5 ENCLOSURES

A. Fire-Pump Controllers, ATS, Remote Alarm Panels, and Low-Suction-Shutdown Panels: NEMA 250, to comply with environmental conditions at installed locations and NFPA 20.

1. Indoor, Dry and Clean Locations: Type 1 (IEC IP10).

B. Enclosure Color: Manufacturer's standard "fire-pump-controller red".

C. Nameplates: Comply with NFPA 20; complete with capacity, characteristics, approvals, listings, and other pertinent data.

D. Optional Features:

1. Floor stands, 12 inches high, for floor-mounted controllers.
2. Space heater, 120-V ac, with thermostat.
3. Tropicalization.

2.6 SOURCE QUALITY CONTROL

A. Testing: Test and inspect fire-pump controllers according to requirements in NFPA 20 and UL 218.

1. Verification of Performance: Rate controllers according to operation of functions and features specified.

B. Fire-pump controllers will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive equipment, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine equipment before installation. Reject equipment that is wet or damaged by moisture or mold.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROLLER INSTALLATION

A. Install controllers within sight of their respective drivers.

B. Connect controllers to their dedicated pressure-sensing lines.

C. Wall-Mounting Controllers: Install controllers on walls with disconnect operating handles not higher than 79 inches above finished floor, and bottom of enclosure not less than 12 inches above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

D. Floor-Mounting Controllers: Install controllers on 4-inch nominal-thickness concrete bases, using floor stands high enough so that the bottom of enclosure cabinet is not less than 12 inches above finished floor. Comply with requirements for concrete bases specified in Division 03 Section.

1. 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.
2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete floor.
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.

E. Seismic Bracing: Comply with requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

G. Comply with NEMA ICS 15.

3.3 REMOTE ALARM AND LOW-SUCTION-SHUTDOWN PANEL INSTALLATION

A. Install panels on walls with tops not higher than 72 inches above finished floor unless otherwise indicated. Bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For ATS not on walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

3.4 POWER WIRING INSTALLATION

A. Install power wiring between controllers and their services or sources, and between controllers and their drivers. Comply with requirements in NFPA 20, NFPA 70, and Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.5 CONTROL AND ALARM WIRING INSTALLATION

A. Install wiring between controllers and remote devices and facility's central monitoring system. Comply with requirements in NFPA 20, NFPA 70, and Division 26 Section "Control-Voltage Electrical Power Cables."

B. Install wiring between remote alarm and low-suction-shutdown panels and controllers. Comply with requirements in NFPA 20, NFPA 70, and Division 26 Section "Control-Voltage Electrical Power Cables."

C. Install wiring between controllers and the building's fire-alarm system. Comply with requirements specified in Division 28 Section "Digital, Addressable Fire-Alarm System."

D. Bundle, train, and support wiring in enclosures.

E. Connect remote manual and automatic activation devices where applicable.

3.6 IDENTIFICATION

A. Comply with requirements in NFPA 20 for marking fire-pump controllers.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification in NFPA 20 and as specified in Division 26 Section "Identification for Electrical Systems."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

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. Acceptance Testing Preparation:

1. Inspect and Test Each Component:

a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
b. Test insulation resistance for each element, component, connecting supply, feeder, and control circuits.
c. Test continuity of each circuit.

2. Verify and Test Each Electric-Driver Controller:

a. Verify that voltages at controller locations are within plus 10 or minus 1 percent of motor nameplate rated voltages, with motors off. If outside this range for any motor, notify Construction Manager before starting the motor(s).
b. Test each motor for proper phase rotation.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Field Acceptance Tests:

1. Do not begin field acceptance testing until suction piping has been flushed and hydrostatically tested and the certificate for flushing and testing has been submitted to Construction Manager and authorities having jurisdiction.
2. Prior to starting, notify authorities having jurisdiction of the time and place of the acceptance testing.
3. Engage manufacturer's factory-authorized service representative to be present during the testing.
4. Perform field acceptance tests as outlined in NFPA 20.

F. Controllers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.8 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.

3.9 ADJUSTING

A. Adjust controllers and battery charger systems to function smoothly and as recommended by manufacturer.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, and timers.

C. 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.

D. Set field-adjustable pressure switches.

3.10 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controllers**,** remote alarm panels, low-suction-shutdown panels, and to use and reprogram microprocessor-based controls within this equipment.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Equipment installation requirements common to equipment sections.
5. Painting and finishing.
6. Supports and anchorages.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.
2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 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.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

A. Refer to individual Division 22 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:
1. CPVC Piping: ASTM F 493.
2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

3. PVC to ABS Piping Transition: ASTM D 3138.

2.4 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Available Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Nonconductive and suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 125-psig minimum working pressure at 180 deg F.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 125-psig minimum working pressure at 180 deg F as required to suit system pressures.

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150-psig minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

a. Calpico, Inc.
b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

1. Available Manufacturers:

    a. Perfection Corp.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Co., Inc.
    d. Victaulic Co. of America.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.

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, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

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 to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.

M. Verify final equipment locations for roughing-in.

N. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. 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.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. 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 unless dry seal threading is specified.
2. 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.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. 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.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Non-pressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Non-pressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Non-pressure Piping Gasketed Joints: Join according to ASTM D 3212.

3.3 PIPING CONNECTIONS

A. 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.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.

D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

END OF SECTION

SECTION 22 05 13

COMMON MOTOR REQUIREMENTS FOR PLUMBING 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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 104 deg F and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

END OF SECTION

SECTION 22 05 17

SLEEVES AND SLEEVE SEALS FOR PLUMBING 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. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

G. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Flexicraft Industries.
4. GPT; Link-Seal.
5. Metraflex Company (The).
6. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Reinforced Plastic.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Pre-sealed Systems.

B. Description: Manufactured plastic, sleeve-type, water-stop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber water-stop collar with center opening to match piping OD.

2.4 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 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 manufacturer's recommended 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, seal the 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 joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 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.

3.3 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 water-stop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

3.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

    a. Galvanized-steel wall sleeves.

2. Exterior Concrete Walls below Grade:

    a. Galvanized-steel wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for manufacturer's recommended annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade:

    a. Galvanized-steel wall sleeves with sleeve-seal system.

        1) Select sleeve size to allow for manufacturer's recommended annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade:

    a. Galvanized-steel-pipe sleeves.

5. Interior Partitions:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 22 05 18

ESCUTCHEONS FOR PLUMBING 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. Escutcheons.
2. Floor plates.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

D. Split-Casting Brass Type: With polished, chrome-plated finish and with concealed hinge and setscrew.

E. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange.

B. Split-Casting Floor Plates: Cast brass 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 insulated 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 type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated 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: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 19

METERS AND GAGES FOR PLUMBING 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. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.
7. Sight flow indicators.

B. Related Sections:
1. Division 21 fire-suppression piping Sections for fire-protection pressure gages.
2. Division 22 Section "Domestic Water Piping" for water meters inside the building.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product Certificates: For each type of meter and gage, from manufacturer.

C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ashcroft Inc.
b. Miljoco Corporation.

c. Palmer Wahl Instrumentation Group.
d. Trerice, H. O. Co.
e. Weiss Instruments, Inc.
f. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 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: Lead free brass.
4. Material for Use with Steel Piping: Stainless steel.
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.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ashcroft Inc.
b. Marsh Bellofram.
c. Miljoco Corporation.
d. Noshok.
e. Palmer Wahl Instrumentation Group.
f. REOTEMP Instrument Corporation.
g. Trerice, H. O. Co.

h. Weiss Instruments, Inc.
i. WIKA Instrument Corporation - USA.
j. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Sealed type; stainless steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and porous-metal-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4, ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Miljoco Corporation.
2. Peterson Equipment Co., Inc.
3. Sisco Manufacturing Company, Inc.
4. Trerice, H. O. Co.
5. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
6. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: EPDM self-sealing rubber.

2.6 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Miljoco Corporation.

2. Peterson Equipment Co., Inc.
3. Sisco Manufacturing Company, Inc.
4. Trerice, H. O. Co.
5. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
6. Weiss Instruments, Inc.

B. Furnish one test-plug kit containing two thermometers, 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.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. 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.

E. 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.

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.7 SIGHT FLOW INDICATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Archon Industries, Inc.
2. Dwyer Instruments, Inc.
3. Emerson Process Management; Brooks Instrument.
4. Ernst Co., John C., Inc.
5. Ernst Flow Industries.
6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
7. OPW Engineered Systems; a Dover company.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and flapper or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 125 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 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.

H. Install test plugs in piping tees.

I. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Inlets and outlet of each thermostatic mixing valve.

J. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

A. Thermometers shall be the following:

1. Industrial-style, liquid-in-glass type.
2. Test plug with EPDM self-sealing rubber inserts.

B. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F.

B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F.

C. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F.

3.6 PRESSURE-GAGE SCHEDULE

A. Pressure gages shall be the following:

1. Sealed, direct-mounted, metal case.
2. Test plug with EPDM self-sealing rubber inserts.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 200 psi.

B. Scale Range for Domestic Water Piping: 0 to 200 psi.

END OF SECTION

SECTION 22 05 23

GENERAL-DUTY VALVES FOR PLUMBING 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. Bronze angle valves.
2. Bronze ball valves.
3. Bronze swing check valves.
4. Bronze globe valves.

B. Related Sections:

1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
2. ASME B31.1 for power piping valves.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 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. Set angle and globe valves closed to prevent rattling.
4. Set ball valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. 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

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:

1. Handwheel: For valves other than quarter-turn types.
2. Handlever: For quarter-turn valves.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:

1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: With extended neck.

F. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Grooved: With grooves according to AWWA C606.
3. Solder Joint: With sockets according to ASME B16.18.
4. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

A. Class 125, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Valve, Inc.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

B. Class 150, Bronze Angle Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hammond Valve.
b. Milwaukee Valve Company.
c. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. Hammond Valve.
    d. Legend Valve.
    e. Milwaukee Valve Company.
    f. NIBCO INC.
    g. Watts; a Watts Water Technologies company.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig.
    c. CWP Rating: 600 psig.
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

B. Two-Piece, Regular-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Valve, Inc.
    b. Conbraco Industries, Inc.; Apollo Valves.
    c. Hammond Valve.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Watts; a Watts Water Technologies company.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig.
    c. CWP Rating: 600 psig.
    d. Body Design: Two piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Regular.

C. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.; Apollo Valves.
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO INC.

2. Description:

    a. Standard: MSS SP-110.
    b. SWP Rating: 150 psig.
    c. CWP Rating: 600 psig.
    d. Body Design: Three piece.
    e. Body Material: Bronze.
    f. Ends: Threaded.
    g. Seats: PTFE or TFE.
    h. Stem: Bronze.
    i. Ball: Chrome-plated brass.
    j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.; Apollo Valves.
    b. Hammond Valve.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Watts; a Watts Water Technologies company.

2. 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.
    f. Disc: PTFE or TFE.

B. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hammond Valve.
    b. Milwaukee Valve Company.
    c. NIBCO INC.
    d. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 300 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

2.5 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. NIBCO INC.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 200 psig.
c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

B. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Hammond Valve.
c. Milwaukee Valve Company.
d. NIBCO INC.
e. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. CWP Rating: 300 psig.
c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
d. Ends: Threaded.
e. Stem: Bronze.
f. Disc: PTFE or TFE.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron.

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 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.
2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.

3.3 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.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball or butterfly valves.
2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
3. Throttling Service: Globe or butterfly valves.
4. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller for Domestic Water: Bronze swing check valves with nonmetallic disc.

b. NPS 2 and Smaller for Sanitary Waste and Storm Drainage: Bronze lift check valves with nonmetallic disc.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. 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 below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.
7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.5 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 Angle Valves: Class 125 minimum, nonmetallic disc.
3. Ball Valves: Two-piece, full port, bronze with brass/bronze trim.
4. Bronze Swing Check Valves: Class 125 minimum, nonmetallic disc.
5. Bronze Globe Valves: Class 125 minimum, nonmetallic disc.

3.6 SANITARY-WASTE AND STORM-DRAINAGE VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125 minimum, nonmetallic disc.
3. Ball Valves: Two-piece, full port, bronze with brass/bronze trim.
4. Bronze Swing Check Valves: Class 125 minimum, nonmetallic disc.
5. Bronze Globe Valves: Class 125 minimum, nonmetallic disc.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING 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. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 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.

B. Structural Performance: Hangers and supports for plumbing 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.

1.5 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. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. 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.

D. Welding certificates.

1.6 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

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 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.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cooper B-Line, Inc.
    b. Flex-Strut Inc.
    c. Thomas & Betts Corporation.
    d. Unistrut; a part of Atkore International.
    e. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Clement Support Services.
2. ERICO International Corporation.
3. National Pipe Hanger Corporation.
4. PHS Industries, Inc.
5. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
6. Piping Technology & Products, Inc.
7. Rilco Manufacturing Co., Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: 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.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Plastic.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.9 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, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, non-corrosive, and non-gaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 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. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing 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.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.

G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. See Division 22 plumbing fixture Sections for requirements for pipe positioning systems for plumbing fixtures.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. 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.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. 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.

M. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. 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.

O. 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.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 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.

3.3 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.

3.4 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.

3.5 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. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 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 non-metallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

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 non-insulated 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 non-insulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, 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.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

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. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53

IDENTIFICATION FOR PLUMBING 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. Valve tags.
5. Warning tags.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

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.

1.4 COORDINATION

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.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. 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.
4. Fasteners: Stainless-steel rivets.
5. 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 thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 200 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.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number.

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), plus 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 thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 200 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.

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.

B. Pretensioned Pipe Labels: Pre-coiled, 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, 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: Varies depending on pipe diameter.

2.4 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 or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or 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.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock or vinyl, with matte finish suitable for writing.

1. Size: Varies.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 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.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. 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 25 feet.

B. Pipe Label Color Schedule:

1. Domestic Cold Water Piping:

   a. Background Color: Green.
   b. Letter Color: White.

2. Domestic Hot Water Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3. Hot Water Return Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

4. Sanitary Vent Piping:

   a. Background Color: Green.
   b. Letter Color: White.

5. Storm Drain Piping:

   a. Background Color: Green.
   b. Letter Color: White.

6. Natural Gas Piping:

   a. Background Color: Yellow.
   b. Letter Color: Black.

3.4 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. 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: 1-1/2 inches, round.

   2. Valve-Tag Color: Natural.

   3. Letter Color: Black.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Division 22 Section "Plumbing Equipment Insulation."

1.3 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).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.
6. Detail application at linkages of control devices.

C. Qualification Data: For qualified Installer.

D. 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.

E. Field quality-control reports.

1.4 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.

1.5 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.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "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.

C. Coordinate installation and testing of heat tracing.

1.7 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

2.1 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 Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. CertainTeed Corp.; SoftTouch Duct Wrap.
    b. Johns Manville; Microlite.
    c. Knauf Insulation; Friendly Feel Duct Wrap.
    d. Manson Insulation Inc.; Alley Wrap.
    e. Owens Corning; SOFTR All-Service Duct Wrap.

E. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Fibrex Insulations Inc.; Coreplus 1200.
    b. Johns Manville; Micro-Lok.
    c. Knauf Insulation; 1000-Degree Pipe Insulation.
    d. Manson Insulation Inc.; Alley-K.
    e. Owens Corning; Fiberglas Pipe Insulation.

2. 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-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ramco Insulation, Inc.; Super-Stik.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ramco Insulation, Inc.; Thermokote V.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 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.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic

Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-30.
    b. Eagle Bridges - Marathon Industries; 501.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
    d. Mon-Eco Industries, Inc.; 55-10.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
3. Service Temperature Range: 0 to 180 deg F.
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
    b. Eagle Bridges - Marathon Industries; 570.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    b. Eagle Bridges - Marathon Industries; 550.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    d. Mon-Eco Industries, Inc.; 55-50.
    e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
    b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
    c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

B. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

2.7 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. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 428 AWF ASJ.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
   c. Compac Corporation; 104 and 105.
   d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 488 AWF.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
   c. Compac Corporation; 120.
   d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ITW Insulation Systems; Gerrard Strapping and Seals.
   b. RPR Products, Inc.; Insul-Mate Strapping and Seals.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 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: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. C & F Wire.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
    b. McGuire Manufacturing.
    c. Plumberex.
    d. Truebro; a brand of IPS Corporation.
    e. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. 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.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Truebro; a brand of IPS Corporation.
    b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 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.

3.2 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 maximum 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.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof 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 roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

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.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. 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 Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.4 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. Stencil or 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. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 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.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. 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.

3.7 FINISHES

A. Insulation with ASJ, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

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.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. 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.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 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.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. All Pipe Sizes: Insulation shall be one of the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.11 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. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:
1. Stainless Steel, Type 304, Smooth 2B Finish: 0.016 inch thick.

END OF SECTION

SECTION 22 11 16

DOMESTIC WATER 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. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
2. Encasement for piping.
3. Flexible connectors.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Domestic water piping and support and installation shall withstand effects of earthquake motions determined according to ASCE/SEI 7.

1.4 SUBMITTALS

A. Product Data: For the following products:

1. Specialty valves.
2. Transition fittings.
3. Flexible connectors.

B. Water Samples: Specified in "Cleaning" Article.

C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:

1. Fire-suppression-water piping.
2. Domestic water piping.
3. HVAC piping and ductwork.
4. Electrical conduits.

D. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 61 for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 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.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
4. 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.
5. Copper Pressure-Seal-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Elkhart Products Corporation; APOLLOXPRESS.
        2) NIBCO INC.
        3) Viega; Plumbing and Heating Systems.

    b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.

6. Grooved-Joint Copper-Tube Appurtenances:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Anvil International.
        2) Shurjoint Piping Products.
        3) Victaulic Company.

    b. Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
    c. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
2. Copper Pressure-Seal-Joint Fittings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Elkhart Products Corporation; APOLLOXPRESS.
        2) NIBCO INC.
        3) Viega; Plumbing and Heating Systems.

    b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Tube.

C. Material: LLDPE film of 0.008-inch minimum thickness.

D. Color: Black.

2.5 TRANSITION FITTINGS

A. Refer to Division 22 Section “Common Work Results for Plumbing” for commonly used transition and dielectric fittings.

B. 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.

C. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

D. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cascade Waterworks Manufacturing.
    b. Dresser, Inc.; Dresser Piping Specialties.
    c. Ford Meter Box Company, Inc. (The).
    d. JCM Industries.
    e. Romac Industries, Inc.
    f. Smith-Blair, Inc; a Sensus company.
    g. Viking Johnson; c/o Mueller Co.

2.6 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld, Inc.
5. Hyspan Precision Products, Inc.
6. Mercer Rubber Co.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. Tozen Corporation.
10. Unaflex, Inc.
11. Universal Metal Hose; a Hyspan company

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 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 and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install domestic water piping level without pitch and plumb.

F. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

G. 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.

H. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

I. Install piping adjacent to equipment and specialties to allow service and maintenance.

J. Install piping to permit valve servicing.

K. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

L. Install piping free of sags and bends.

M. Install fittings for changes in direction and branch connections.

N. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

O. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.

P. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.

Q. Install thermometers on outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. 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.

D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.

E. Soldered Joints: 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."

F. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

I. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.

B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 and smaller. Use butterfly valves for piping NPS 2-1/2 and larger.

C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."

1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

D. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

3.5 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. NPS 1-1/2 and Smaller: Fitting-type coupling.
2. NPS 2 and Larger: Sleeve-type coupling.

3.6 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.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.

3.7 FLEXIBLE CONNECTOR INSTALLATION

A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.

B. Install bronze-hose flexible connectors in copper domestic water tubing.

C. Install stainless-steel-hose flexible connectors in steel domestic water piping.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

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. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring 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.
6. NPS 6: 10 feet with 5/8-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-69 and manufacturer's written instructions.

3.9 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment and machines to allow 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 required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
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.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

B. Label pressure piping with system operating pressure.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Piping Inspections:

1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
2. 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:

    a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

C. Piping Tests:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. 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.
3. 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.
4. 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 to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
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 for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 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 flow of hot water 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.

3.13 CLEANING

A. Clean and disinfect potable and non-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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Clean non-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 procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 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. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper solder-joint fittings; and brazed joints; or copper pressure-seal-joint fittings; and pressure-sealed joints.

E. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

F. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; wrought-copper solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L; grooved-joint copper-tube appurtenances; and grooved joints.

3.15 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 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Temperature-actuated water mixing valves.
5. Strainers.
6. Outlet boxes.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water hammer arresters.

B. Related Sections include the following:

1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 22 Section "Domestic Water Piping" for water meters.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme.
b. Conbraco Industries, Inc.
c. FEBCO; a Watts Water Technologies Company.
d. MIFAB, Inc.; BEECO.
e. Watts; a Watts Water Technologies Company.
f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme.
b. Conbraco Industries, Inc.
c. MIFAB, Inc.; BEECO.
d. Watts; a Watts Water Technologies Company.
e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or rough bronze finish to match faucet or hose bibb.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. FEBCO; a Watts Water Technologies Company.
    d. MIFAB, Inc.; BEECO.
    e. Watts; a Watts Water Technologies Company.
    f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Accessories:

    a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. Watts; a Watts Water Technologies Company.
    d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/2 or NPS 3/4, as required to match connected piping.
5. Body: Bronze.
6. End Connections: Union joint.
7. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.; a Watts Water Technologies Company.
    b. Conbraco Industries, Inc.
    c. FEBCO; a Watts Water Technologies Company.
    d. Flomatic Corporation.
    e. Watts; a Watts Water Technologies Company.
    f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Size: As required to match connected piping.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.

7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through; vertical inlet, horizontal center section, and vertical outlet; or vertical flow.
9. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; ball type or outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.; a Watts Water Technologies Company.
    b. Conbraco Industries, Inc.
    c. FEBCO; a Watts Water Technologies Company.
    d. Flomatic Corporation.
    e. Watts; a Watts Water Technologies Company.
    f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Size: As required to match connected piping.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight through; vertical inlet, horizontal center section, and vertical outlet; or vertical flow.
9. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; ball type or outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

D. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. Flomatic Corporation.
    d. Watts; a Watts Water Technologies Company.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/2 to NPS 1-1/4, as required to match connected piping.
5. Body: Bronze with union inlet.

E. Hose-Connection Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. Watts; a Watts Water Technologies Company.

2. Standard: ASSE 1052.
3. Operation: Up to 10-foot head of water back pressure.
4. Inlet Size: NPS 3/4.
5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
6. Capacity: At least 3-gpm flow.

F. Backflow-Preventer Test Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; a Watts Water Technologies Company.
    c. Flomatic Corporation.
    d. Watts; a Watts Water Technologies Company.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.3 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Bell & Gossett; a Xylem brand.
    c. Conbraco Industries, Inc.
    d. NIBCO INC.
    e. Taco, Inc.
    f. Watts Industries, Inc.; Water Products Div.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: Brass or bronze.
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.4 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Cash Acme.
    b. Conbraco Industries, Inc.

c. Legend Valve.
d. Leonard Valve Company.
e. Powers; a Watts Water Technologies Company.
f. Symmons Industries, Inc.
g. Taco, Inc.
h. Watts Industries, Inc.; Water Products Div.
i. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded or sweat union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F.
9. Tempered-Water Design Flow Rate: Refer to schedule on drawings.
10. Valve Finish: Rough bronze.

2.5 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 with interior lining complying with AWWA C550 or FDA-approved, epoxy coating 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.
c. Strainers NPS 5 and Larger: 0.125 inch.

6. Drain: Pipe plug.

2.6 OUTLET BOXES

A. Icemaker Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Engineering Company.
b. IPS Corporation; Guy Gray.
c. IPS Corporation; Water-Tite.
d. LSP Products Group, Inc.
e. Oatey.
f. Sioux Chief Manufacturing Company, Inc.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.

4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 ball valve with water hammer arrester, and NPS 1/2 copper, water tubing.

2.7 HOSE BIBBS

A. Hose Bibbs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Chicago Faucets.

    b. Zurn

    c. JR Smith

    d. Prier

    e. Woodford
    f. T & S Brass and Bronze Works, Inc.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 threaded inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral, nonremovable complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough chrome.
10. Finish for Service Areas: Polished chrome plated.
11. Finish for Finished Rooms: Polished chrome plated.
12. Operation for Equipment Rooms: Operating key.
13. Operation for Service Areas: Operating key.
14. Operation for Finished Rooms: Operating key.
15. Include operating key with each operating-key hose bibb.
16. Include integral wall flange with each hose bibb.

2.8 WALL HYDRANTS

A. Non-freeze Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company.
    b. McWane, Inc.; Wade Specification Drainage Products.
    c. MIFAB, Inc.
    d. Prier Products, Inc.
    e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    f. Watts Drainage Products Inc.
    g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company.
    b. Prier Products, Inc.
    c. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Woodford Manufacturing Company.
    e. Zurn Plumbing Products Group; Light Commercial Operation.

2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.9 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.

B. Gate-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves:

1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig minimum CWP or Class 125.
3. Size: NPS 3/4.
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 side outlet with cap.

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company.
   b. McWane, Inc.; Wade Specification Drainage Products.
   c. MIFAB, Inc.
   d. PPP Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   g. Watts Drainage Products Inc.
   h. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. 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 not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each backflow preventer, control valve, water pressure-reducing valve, solenoid valve, and pump.

G. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

H. Install water hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Double-check backflow-prevention assemblies.
5. Dual-check-valve backflow preventers.
6. Calibrated balancing valves.
7. Primary water tempering valves.
8. Outlet boxes.

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 Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and prepare test reports:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 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 22 11 23

FACILITY NATURAL GAS 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. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.
7. Concrete bases.

1.3 DEFINITIONS

A. 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.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 2 psig.

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig but not more than 2 psig.

C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Service meters. Indicate pressure ratings and capacities. Include bypass fittings.
6. Dielectric fittings.

1.6 INFORMATIONAL SUBMITTALS

A. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.

B. Qualification Data: For qualified professional engineer.

C. Welding certificates.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators and service meters to include in emergency, operation, and maintenance manuals.

1.8 QUALITY ASSURANCE

A. Steel Support 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.

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.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. 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.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.10 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.11 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

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Dresser Piping Specialties; Division of Dresser, Inc.
        2) Smith-Blair, Inc.

    b. Steel flanges and tube with epoxy finish.
    c. Buna-nitrile seals.
    d. Steel bolts, washers, and nuts.

e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. OmegaFlex, Inc.
b. Parker Hannifin Corporation; Parflex Division.
c. Titeflex.
d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1) Flame-Spread Index: 25 or less.
2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.

8. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.

a. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

1) Dresser Piping Specialties; Division of Dresser, Inc.
2) Smith-Blair, Inc.

b. Steel flanges and tube with epoxy finish.
c. Buna-nitrile seals.
d. Steel bolts, washers, and nuts.
e. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.

3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Basket Strainers:

1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
2. End Connections: Grooved ends.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
4. CWP Rating: 750 psig.

F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lee Brass Company.
    b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.

4. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

H. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. McDonald, A. Y. Mfg. Co.
    b. Mueller Co.; Gas Products Div.
    c. Xomox Corporation; a Crane company.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

I. Cast-Iron, Lubricated Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Flowserve.
    b. Homestead Valve; a division of Olson Technologies, Inc.
    c. McDonald, A. Y. Mfg. Co.
    d. Milliken Valve Company.
    e. Mueller Co.; Gas Products Div.
    f. R&M Energy Systems, A Unit of Robbins & Myers, Inc.

2. Body: Cast iron, complying with ASTM A 126, Class B.
3. Plug: Bronze or nickel-plated cast iron.
4. Seat: Coated with thermoplastic.
5. Stem Seal: Compatible with natural gas.
6. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. Operator: Square head or lug type with tamperproof feature where indicated.
8. Pressure Class: 125 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

J. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Kerotest Manufacturing Corp.
    b. Lyall, R. W. & Company, Inc.
    c. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: 80 psig.
8. Operating Temperature: Minus 20 to plus 140 deg F.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

K. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Fisher Control Valves and Regulators; Division of Emerson Process Management.
    d. Invensys.
    e. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.

7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig.

C. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Eclipse Combustion, Inc.
    d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
    e. Invensys.
    f. Maxitrol Company.
    g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 2 psig.

D. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Company.
    e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.

7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig.

2.6 SERVICE METERS

A. Diaphragm-Type Service Meters: Comply with ANSI B109.1.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Invensys.

2. Case: Die-cast aluminum.
3. Connections: Steel threads.
4. Diaphragm: Synthetic fabric.
5. Diaphragm Support Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet.
8. Meter Case and Index: Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig.
11. Pressure Loss: Maximum 0.5-inch wg.
12. Accuracy: Maximum plus or minus 1.0 percent.

B. Rotary-Type Service Meters: Comply with ANSI B109.3.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Meter Company.
    b. Invensys.

2. Case: Extruded aluminum.
3. Connection: Flange.
4. Impellers: Polished aluminum.
5. Rotor Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet.
8. Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig.
11. Accuracy: Maximum plus or minus 2.0 percent.

C. Turbine Meters: Comply with ASME MFC-4M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Meter Company.
    b. Invensys.

2. Housing: Cast iron or welded steel.
3. Connection Threads or Flanges: Steel.
4. Turbine: Aluminum or plastic.
5. Turbine Bearings: Self-lubricating.
6. Compensation: Continuous temperature and pressure.
7. Meter Index: Cubic feet.
8. Tamper resistant.
9. Remote meter reader compatible.
10. Maximum Inlet Pressure: 100 psig.
11. Accuracy: Maximum plus or minus 2.0 percent.

D. Service-Meter Bars:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Actaris.
    b. American Meter Company.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Mueller Co.; Gas Products Div.
    f. Perfection Corporation; a subsidiary of American Meter Company.

2. Malleable- or cast-iron frame for supporting service meter.
3. Include offset swivel pipes, meter nuts with o-ring seal, and factory- or field-installed dielectric unions.
4. Omit meter offset swivel pipes if service-meter bar dimensions match service-meter connections.

E. Service-Meter Bypass Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Lyall, R. W. & Company, Inc.
    b. Williamson, T. D., Inc.

2. Ferrous, tee, pipe fitting with capped side inlet for temporary natural-gas supply.
3. Integral ball-check bypass valve.

2.7 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Jomar International Ltd.

e. Matco-Norca, Inc.
f. McDonald, A. Y. Mfg. Co.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
h. Wilkins; a Zurn company.

2. 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.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Company.
b. Central Plastics Company.
c. Matco-Norca, Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Wilkins; a Zurn company.

2. Description:

a. Standard: ASSE 1079.
b. Factory-fabricated, bolted, companion-flange assembly.
c. Pressure Rating: 125 psig minimum at 180 deg F.
d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Description:

a. Nonconducting materials for field assembly of companion flanges.
b. Pressure Rating: 150 psig.
c. Gasket: Neoprene or phenolic.
d. Bolt Sleeves: Phenolic or polyethylene.
e. Washers: Phenolic with steel backing washers.

2.8 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

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Install fittings for changes in direction and branch connections.

F. Install pressure gage downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. 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.

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 natural-gas 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 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 (75 mm) 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 natural-gas 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: Natural-gas 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 natural-gas 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 natural-gas 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. Unions are not required at flanged connections.

T. Do not use natural-gas 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 230519 "Meters and Gages for HVAC Piping."

W. 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."

X. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

Y. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.5 SERVICE-METER ASSEMBLY INSTALLATION

A. Install service-meter assemblies aboveground on concrete bases.

B. Install metal shutoff valves upstream from service regulators. Shutoff valves are not required at second regulators if two regulators are installed in series.

C. Install strainer on inlet of service-pressure regulator and meter set.

D. Install service regulators mounted outside with vent outlet horizontal or facing down. Install screen in vent outlet if not integral with service regulator.

E. Install metal shutoff valves upstream from service meters. Install dielectric fittings downstream from service meters.

F. Install service meters downstream from pressure regulators.

G. Install metal bollards to protect meter assemblies. Comply with requirements in Section 055000 "Metal Fabrications" for pipe bollards.

3.6 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or 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.

E. Install anode for metallic valves in underground PE piping.

3.7 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 inside diameter 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. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.8 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.

C. Install hangers for horizontal drawn-temper copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2 and NPS 5/8: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and NPS 7/8: Maximum span, 84 inches; minimum rod size, 3/8 inch.
4. NPS 1: Maximum span, 96 inches; minimum rod size, 3/8 inch.

D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.9 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. 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 230553 "Identification for HVAC 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. Comply with requirements in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting" for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, 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 flat.
d. Color: Gray.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, 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 flat.
d. Color: Gray.

2. Alkyd System: MPI INT 5.1E.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd flat.
d. Color: Gray.

D. 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.

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 natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas 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 earthquake valves.

3.15 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:
   1. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be one of the following:

   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

   1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
   2. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be one of the following:

   1. Steel pipe with malleable-iron fittings and threaded joints.
   2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.17 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
2. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with steel welding fittings and welded joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.18 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground:
1. NPS 2 and Smaller: Bronze plug valves.
2. NPS 2-1/2 and Larger: Cast-iron, lubricated plug valves.

3.19 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.
3. Cast-iron, nonlubricated plug valve.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

2. Bronze plug valve.
3. Cast-iron, n**o**nlubricated plug valve.

E. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION

SECTION 22 11 23.13

DOMESTIC-WATER PACKAGED BOOSTER PUMPS

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. Multiplex, variable-speed booster pumps.

B. Related Sections:

1. Division 22 Section "Domestic Water Pumps" for domestic-water circulation pumps.

1.3 DEFINITIONS

A. VFC: Variable-frequency controller(s).

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, and dimensions of individual components and profiles. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For booster pumps. 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. Operation and Maintenance Data: For booster pumps to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Comply with ASME B31.9 for piping.

C. UL Compliance for Packaged Pumping Systems:

1. UL 508, "Industrial Control Equipment."
2. UL 508A, "Industrial Control Panels."
3. UL 778, "Motor-Operated Water Pumps."
4. UL 1995, "Heating and Cooling Equipment."

D. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Retain protective coatings and flange's protective covers during storage.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 MULTIPLEX, VARIABLE-SPEED BOOSTER PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong Fluid Technology.
2. Bell & Gossett; a Xylem brand.
3. Canariis Corporation.
4. Delta P Carver.
5. Grundfos Pumps Corporation U.S.A.
6. Patterson Pump Company; a subsidiary of the Gorman-Rupp Company.
7. SyncroFlo, Inc.
8. TIGERFLOW Systems, Inc.

B. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.

C. Pumps:

1. Type: Vertical, multistage as defined in HI 1.1-1.2 and HI 1.3 for in-line, multistage, separately coupled, overhung-impeller, centrifugal pump.
2. Casing: Cast-iron or steel base and stainless-steel chamber.
3. Impeller: Closed, stainless steel; statically and dynamically balanced and keyed to shaft.
4. Shaft: Stainless steel.
5. Seal: Mechanical.
6. Bearing: Water-lubricated sleeve type.

D. Motors: Single speed, with grease-lubricated or pre-greased, permanently shielded, ball-type bearings. Select motors that will not overload through full range of pump performance curve.

E. Piping: Copper tube and copper fittings.

F. Valves:

1. Shutoff Valves NPS 2 and Smaller: Two-piece, full-port ball valve, in each pump's suction and discharge piping.
2. Shutoff Valves NPS 2-1/2 and Larger: Lug-type butterfly valve, in each pump's suction and discharge piping and in inlet and outlet headers.
3. Check Valves NPS 2 and Smaller: Silent type in each pump's discharge piping.
4. Check Valves NPS 2-1/2 and Larger: Silent type in each pump's discharge piping.
5. Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.

G. Dielectric Fittings: With insulating material isolating joined dissimilar metals.

H. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for multiple-pump, variable-speed operation, with load control and protection functions.

1. Control Logic: Solid-state system with transducers, programmable microprocessor, VFC, and other devices in controller. Install VFC for pump motors larger than 25 hp in separate panel; same type as motor control panel enclosure.
2. Motor Controller: NEMA ICS 2, variable-frequency, solid-state type.

    a. Control Voltage: 120-V ac, with integral control-power transformer.

3. Enclosure: NEMA 250, Type 1.
4. Motor Overload Protection: Overload relay in each phase.
5. Starting Devices: Hand-off-automatic selector switch for each pump in cover of control panel, plus pilot device for automatic control.

    a. Duplex, Automatic, Alternating Starter: Switches lead pump to lag main pump and to two-pump operation.

6. Pump Operation and Sequencing: Pressure-sensing method.

    a. Time Delay: Controls pump on-off operation; adjustable from 1 to 300 seconds.

7. VFC: Voltage-source, pulse-width, modulating-frequency converter for each pump.
8. Manual Bypass: Magnetic contactor arranged to transfer to constant-speed operation upon VFC failure.
9. Instrumentation: Suction and discharge pressure gages.
10. Lights: Running light for each pump.
11. Alarm Signal Device: Sounds alarm when backup pumps are operating.

    a. Time Delay: Controls alarm operation; adjustable from 1 to 300 seconds, with automatic reset.

12. Thermal-bleed cutoff.
13. Low-suction-pressure cutout.
14. High-suction-pressure cutout.
15. Low-discharge-pressure cutout.
16. High-discharge-pressure cutout.
17. Building Automation System Interface: Provide auxiliary contacts for interface to BACnet building automation system. Building automation systems are specified in Division 23 Section "Instrumentation and Control for HVAC." Include the following:

a. On-off status of each pump.
b. Alarm status.

I. Base: Structural steel.

J. Capacities and Characteristics:

1. Minimum Pressure Rating: 150 psig.
2. Booster-Pump Capacity: 170 gpm.
3. Minimum Inlet Pressure: 15 psig.
4. Maximum Inlet Pressure: 25 psig.
5. Discharge Pressure: 70 psig.
6. Low-Suction-Pressure Shutoff: 5 psig.
7. High-Suction-Pressure Shutoff: 40 psig.
8. Single point connection 460 V, 3 phase, 60 hz.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for booster pumps to verify actual locations of piping connections before booster-pump installation.

3.2 INSTALLATION

A. Equipment Mounting: Install booster pumps on skid within fire pump house using elastomeric pads, elastomeric mounts, or restrained spring isolators.

1. Minimum Deflection: 1/4 inch.
2. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
3. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Support connected domestic-water piping so weight of piping is not supported by booster pumps.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect domestic-water piping to booster pumps. Install suction and discharge pipe equal to or greater than size of system suction and discharge headers.

1. Install shutoff valves on piping connections to booster-pump suction and discharge headers. Install ball or butterfly valves same size as suction and discharge headers. Comply with requirements for general-duty valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
2. Install union, flanged, or grooved-joint connections on suction and discharge headers at connection to domestic-water piping. Comply with requirements for unions and flanges specified in Division 22 Section "Domestic Water Piping."
3. Install valved bypass, same size as and between piping, at connections to booster-pump suction and discharge headers. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."
4. Install flexible connectors, same size as piping, on piping connections to booster-pump suction and discharge headers. Comply with requirements for flexible connectors specified in Division 22 Section "Domestic Water Piping."
5. Install piping adjacent to booster pumps to allow service and maintenance.

3.4 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform visual and mechanical inspection.
2. Leak Test: After installation, charge booster pump and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 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.

3.7 ADJUSTING

A. Adjust booster pumps to function smoothly and lubricate as recommended by manufacturer.

B. Adjust pressure set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting booster pump to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain booster pumps.

END OF SECTION

SECTION 22 13 16

SANITARY WASTE AND VENT 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. Pipe, tube, and fittings.
2. Specialty pipe fittings.
3. Encasement for underground metal piping.

1.3 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.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 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.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.

B. CISPI, Hub-less Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ANACO-Husky.
   b. Mission Rubber Company; a division of MCP Industries, Inc.
   c. Tyler Pipe.

2. Standards: ASTM C 1277 and CISPI 310.
3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hub-less Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ANACO-Husky.
   b. Clamp-All Corp.

2. Standards: ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 GALVANIZED-STEEL PIPE AND FITTINGS

A. Galvanized-Steel Pipe: ASTM A 53/A 53M, Type E, Standard Weight class. Include square-cut-grooved or threaded ends matching joining method.

B. Galvanized-Cast-Iron Drainage Fittings: ASME B16.12, threaded.

C. Steel Pipe Pressure Fittings:

1. Galvanized-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106/A 106M, Schedule 40, seamless steel pipe. Include ends matching joining method.
2. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
3. Galvanized-Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, standard pattern.

D. Cast-Iron Flanges: ASME B16.1, Class 125.

1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

E. Grooved-Joint, Galvanized-Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anvil International; a subsidiary of Mueller Water Products, Inc.
    b. Grinnell Mechanical Products.
    c. Shurjoint Piping Products.
    d. Victaulic Company.

2. Galvanized, Grooved-End Fittings for Galvanized-Steel Piping: ASTM A 536 ductile-iron castings, ASTM A 47/A 47M malleable-iron castings, ASTM A 234/A 234M forged steel fittings, or ASTM A 106/A 106M steel pipes with dimensions matching ASTM A 53/A 53M steel pipe, and complying with AWWA C606 for grooved ends.
3. Grooved Mechanical Couplings for Galvanized-Steel Piping: ASTM F 1476, Type I. Include ferrous housing sections with continuous curved keys; EPDM-rubber gasket suitable for hot and cold water; and bolts and nuts.

2.4 SPECIALTY PIPE FITTINGS

A. Refer to Division 22 Section “Common Work Results for Plumbing” for commonly used transition and dielectric fittings.

B. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

3. Shielded, Non-pressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Cascade Waterworks Mfg. Co.
        2) Mission Rubber Company; a division of MCP Industries, Inc.

    b. Standard: ASTM C 1460.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.5 ENCASEMENT FOR UNDERGROUND METAL PIPING

A. Standard: ASTM A 674 or AWWA C105/A 21.5.

B. Material: Linear low-density polyethylene film of 0.008-inch minimum thickness.

C. Form: Tube.

D. Color: Black.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 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 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. 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. 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. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2-1/2 and smaller; 1 percent downward in direction of flow for piping NPS 3 and larger.

2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping NPS 2-1/2 and smaller; 1 percent downward in direction of flow for piping NPS 3 and larger.
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."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Install steel piping according to applicable plumbing code.

O. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

3. Install encasement on piping according to ASTM A 674 or AWWA C105/A 21.5.

P. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."

Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-less, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hub-less-piping coupling joints.

B. 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 unless dry seal threading is specified.

2. 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.

C. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Unshielded, non-pressure transition couplings.

B. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
4. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "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.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches of each fitting, valve, 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. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
6. 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. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 84 inches with 3/8-inch rod.
2. NPS 1-1/2: 108 inches with 3/8-inch rod.
3. NPS 2: 10 feet with 3/8-inch rod.
4. NPS 2-1/2: 11 feet with 1/2-inch rod.
5. NPS 3: 12 feet with 1/2-inch rod.
6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
7. NPS 6 and NPS 8: 12 feet with 3/4-inch rod.
8. NPS 10 and NPS 12: 12 feet with 7/8-inch rod.

H. Install supports for vertical steel piping every 15 feet.

I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 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 drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage 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 drainage 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.
5. Comply with requirements for cleanouts, and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

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.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.8 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 drainage 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 new piping and parts of existing piping that have been altered, extended, or repaired. 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 drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. 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. 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. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. 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.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains 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.

3.10 PIPING SCHEDULE

A. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Hub-less, cast-iron soil pipe and fittings; CISPI heavy-duty hub-less piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

B. Aboveground, soil and waste piping NPS 5 and larger shall be the following:

1. Hub-less, cast-iron soil pipe and fittings; CISPI heavy-duty hub-less piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

C. Aboveground, vent piping NPS 4 and smaller shall be the following:

1. Hub-less, cast-iron soil pipe and fittings; hub-less piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

D. Aboveground, vent piping NPS 5 and larger shall be the following:

1. Hub-less, cast-iron soil pipe and fittings; hub-less piping couplings; and coupled joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints; or calking materials; and calked joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

F. Underground, soil and waste piping NPS 5 and larger shall be the following:

1. Service class, cast-iron soil piping; gaskets; and gasketed joints; or calking materials; and calked joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

END OF SECTION

SECTION 22 13 19

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
1. Cleanouts.
2. Floor drains.
3. Air-admittance valves.
4. Roof flashing assemblies.
5. Through-penetration firestop assemblies.
6. Miscellaneous sanitary drainage piping specialties.
7. Flashing materials.
8. Grease interceptors.
9. Solids interceptors.

B. Related Sections include the following:

1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FRP: Fiberglass-reinforced plastic.

C. HDPE: High-density polyethylene plastic.

D. PE: Polyethylene plastic.

E. PP: Polypropylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. Grease interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

1. Wiring Diagrams: Power, signal, and control wiring.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

a. Josam Company.
b. McWane, Inc.; Wade Specification Drainage Products.
c. MIFAB, Inc.
d. Smith, Jay R. Mfg. Co.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-less, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, bronze plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company.
    b. McWane, Inc.; Wade Specification Drainage Products.
    c. MIFAB, Inc.
    d. Smith, Jay R. Mfg. Co.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Heavy-duty, adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside caulk, no-hub or push-on.
8. Closure: Bronze plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads, set-screws or other device.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Light Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company.
    b. McWane, Inc.; Wade Specification Drainage Products.
    c. MIFAB, Inc.
    d. Smith, Jay R. Mfg. Co.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-less, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, drilled-and-threaded bronze plug.

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company.
    b. McWane, Inc.; Wade Specification Drainage Products.
    c. MIFAB, Inc.
    d. Smith, Jay R. Mfg. Co.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Coating on Interior and Exposed Exterior Surfaces: Not required.
10. Sediment Bucket: Not required unless indicated on floor drain schedule.
11. Top or Strainer Material: As indicated on floor drain schedule.
12. Top of Body and Strainer Finish: As indicated on floor drain schedule.
13. Top Shape: As indicated on floor drain schedule.
14. Dimensions of Top or Strainer: As indicated on floor drain schedule.
15. Top Loading Classification: As indicated on floor drain schedule.
16. Trap Material: Cast iron.
17. Trap Pattern: Standard P-trap.

2.1 FLOOR SINKS

A. Cast-Iron Floor Sinks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company.
    b. McWane, Inc.; Wade Specification Drainage Products.
    c. MIFAB, Inc.
    d. Smith, Jay R. Mfg. Co.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Seepage Flange: Required.

6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Outlet: Bottom.
9. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
10. Sediment Bucket: .
11. Top or Strainer Material: As indicated on floor sink schedule.
12. Top of Body and Strainer Finish: As indicated on floor sink schedule.
13. Top Shape: As indicated on floor sink schedule.
14. Dimensions of Top or Strainer: As indicated on floor sink schedule.
15. Top Loading Classification: As indicated on floor sink schedule.
16. Funnel: As indicated on floor sink schedule.
17. Inlet Fitting: As indicated on floor sink schedule.
18. Trap Material: Cast iron.
19. Trap Pattern: Standard P-trap.

2.2 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Studor Mini-Vent or a comparable product by one of the following:

    a. Ayrlett, LLC.
    b. Durgo, Inc.
    c. Oatey.
    d. Sioux Chief Manufacturing Company, Inc.
    e. Studor, Inc.

2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. 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:

    a. Elmdor/Stoneman; a Member of Morris Group International.
    b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 10 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.

2.4 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. 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:

    a. ProSet Systems Inc.

2. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
3. Size: Same as connected soil, waste, or vent stack.
4. 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.
5. Stack Fitting: ASTM A 48/A 48M, gray-iron, hub-less-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
6. Special Coating: Corrosion resistant on interior of fittings.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft. thickness.
2. Vent Pipe Flashing: 8 oz./sq. ft. thickness.

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.6 GREASE INTERCEPTORS

A. Grease Interceptors:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Josam Company.
    b. Zurn/Green Turtle Plumbing Products Group; Specification Drainage Operation.
    c. McWane, Inc.; Wade Specification Drainage Products.
    d. MIFAB, Inc.
    e. Rockford Sanitary Systems, Inc.
    f. Schier Products Company.
    g. Smith, Jay R. Mfg. Co.
    h. Watts Drainage Products Inc.
    i. Ashland Trap Distribution Co.
    j. Canplas LLC.
    k. MIFAB, Inc.
    l. Schier Products Company.
    m. Thermaco, Inc; Trapzilla.

2. Standard: ASME A112.14.3 and PDI-G101, for intercepting and retaining fats, oils, and greases from food preparation or processing wastewater.
3. Plumbing and Drainage Institute Seal: Required.
4. Body Material: Fiberglass reinforced plastic.
5. Body Dimensions: Refer to manufacturers specification.
6. Body Extension: As required to extend tops to finished grade.
7. Grease Retention Capacity: 577 gallons.
8. Inlet and Outlet Size: 4”.
9. Cleanout: Field installed on inlet and outlet
10. Operation: Manual cleaning.

2.7 SOLIDS INTERCEPTORS

A. Solids Interceptors:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

    a. Zurn/Green Turtle Plumbing Products Group; Specification Drainage Operation.
    b. Josam Company.
    c. McWane, Inc.; Wade Specification Drainage Products.
    d. MIFAB, Inc.
    e. Rockford Sanitary Systems, Inc.
    f. Schier Products Company.
    g. Smith, Jay R. Mfg. Co.
    h. Watts Drainage Products Inc.

2. Type: Factory-fabricated interceptor made for removing and retaining food solids from wastewater.
3. Body Material: Fiberglass reinforced plastic.
4. Interior Separation Device: Refer to manufacturers specifications.

5. Body Dimensions: Refer to manufacturers specifications.
6. Inlet and Outlet Size: 4”.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Anchor underground grease and solids interceptors to concrete bases per the manufacturers installation instructions. Provide all grading, backfill, pea gravel, relieving slabs, extensions, etc. as required to extend tank openings to finished grade. Provide all items as clearly indicated in the manufacturer’s installation instructions.

3.2 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. 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 100 feet.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install fixture air-admittance valves on fixture drain piping.

G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

J. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

K. Install vent caps on each vent pipe passing through roof.

L. Install solids interceptors with cleanout immediately downstream from interceptors that do not have integral cleanout on outlet.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit and connect and vents to unit and route piping to above grade as required.

3.4 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having caulking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3.6 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 22 13 23

SANITARY WASTE INTERCEPTORS

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. Grease interceptors.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

B. PP: Polypropylene plastic.

1.4 SUBMITTALS

A. Product Data: For each type of fiberglass interceptor indicated. Include materials of fabrication, dimensions, rated capacities, retention capacities, operating characteristics, size and location of each pipe connection, furnished specialties, and accessories.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.

1. Include materials of construction, dimensions, rated capacities, retention capacities, location and size of each pipe connection, furnished specialties, and accessories.

C. Coordination Drawings: Interceptors, drawn to scale, on which the following items are shown and coordinated with each other, based on input from Installers of the items involved:

1. Interceptors.
2. Piping connections. Include size, location, and elevation of each.
3. Interface with underground structures and utility services.

PART 2 - PRODUCTS

2.1 GREASE INTERCEPTORS

A. Grease Interceptors: Fiberglass (FRP).

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings.

    a. Include accessways, tanks, and piping and baffle openings to retain grease and solids and to permit tangential laminar wastewater flow.
    b. Pipe Connectors: Factory installed Schedule 40 PVC cement welded type socket ports, or straight pipe, fitted into interceptor walls for each pipe connection.
    c. Accessway Extension Collar: Fiberglass risers (EC2), 24-inch. 36-inch optional alternate.
    d. Accessway Frames and Covers: Round cover with non slip cover finish, gasketed and non vented top design with “Proceptor” lettering cast into cover.

        1) Cast Iron: AASHTO M306 Traffic load rated. 24 inch-diameter cover with 0.25” gasket. Two closed pickholes. Non Bolted or Bolted option. Weight 249 lbs. ASTM A48 CL35B. 36-inch optional alternate is acceptable to match fiberglass risers.
        2) Fiberglass: Pedestrian loading 24” diameter bolted and gasketed.

    e. Watertight Flexible Caulking: Sikaflex 255 or Sikaflex 221 or approved alternate to provide watertight seal at extension collar joints.

2. Capacities and Characteristics:

    a. Length by Width by Depth: As indicated per drawing schedule and manufacturers specifications.
    b. Number of Compartments: As indicated per drawing schedule and manufacturers specifications.
    c. Grease Retention Capacity: 577 gallons.
    d. Inlet and Outlet Pipe Size: 4”.

    e. Vent Pipe Size: Per manufacturer’s specifications.
    f. Installation Position: Underground with accessway collar riser to grade.
    g. Options as required:

        1) 4” Side or Top Suction port for remote pump-out.

2.2 FIBERGLASS ACCESSWAY RISERS

A. Fiberglass accessway extensions: Fiberglass wound pipe.

1. Length: From top of underground tank to underside of access frame at grade.
2. Extension Sections: 0.25-inch minimum thickness and 36-inch I.D. as a single continuous piece, without joints unless approved by the manufacturer.

    a. Sealant: Watertight Flexible Caulking, Sikaflex 255 or Sikaflex 221 or approved alternate to provide watertight seal at extension collar joining to tank on bottom and access frame at top.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 INSTALLATION

A. Install manhole risers from top of underground interceptors to manholes and gratings at finished grade.

B. Set tops of manhole frames and covers flush with finished surface in pavements.

C. Set tops of grating frames and grates flush with finished surface.

D. Set interceptors level and plumb.

E. Set tops of interceptor covers flush with finished surface in pavements.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

A. Identification materials and installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION

SECTION 22 14 23

STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Miscellaneous storm drainage piping specialties.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Downspout Boots:

   1. Description: Manufactured, ASTM A 48/A 48M, gray-iron casting, with strap or ears for attaching to building; NPS 4 outlet; and shop-applied bituminous coating.
   2. Size: Inlet size to match downspout and NPS 4 outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install downspout boots at grade with top 12 inches above grade. Secure to building wall.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 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 22 14 29

SUMP PUMPS

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. Submersible sump pumps.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Operation and Maintenance Data: For pumps and controls, to include in operation and maintenance manuals.

1.4 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.

1.5 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

2.1 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Barnes; Crane Pumps & Systems.
    b. Bell & Gossett; a Xylem brand.
    c. Goulds Pumps; ITT Corporation.
    d. Grundfos Pumps Corp.
    e. Liberty Pumps.
    f. Little Giant Pump Co.
    g. McDonald, A. Y. Mfg. Co.
    h. Pentair Pump Group; Hydromatic Pumps.
    i. Pentair Pump Group; Myers.
    j. Stancor, Inc.
    k. Weil Pump Company, Inc.
    l. Weinman Division; Crane Pumps & Systems.
    m. Zoeller Company.

2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron design for clear wastewater handling, and keyed and secured to shaft.
6. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
7. Seal: Mechanical.
8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

    a. Motor Housing Fluid: Oil.

9. Controls:

    a. Enclosure: NEMA 250, Type 1.
    b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
    c. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Control-Interface Features:

    a. Remote Alarm Contacts: For remote alarm interface.
    b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

        1) On-off status of pump.
        2) Alarm status.

2.2 SUMP PUMP CAPACITIES AND CHARACTERISTICS

A. Number of Pumps: One.

B. Each Pump:

1. Capacity: 50 gpm.
2. Total Dynamic Head: 15 feet.
3. Speed: Refer to manufacturer's specifications as scheduled on drawings.
4. Discharge Size: 2" NPS.
5. Electrical Characteristics:

    a. Motor Horsepower: As scheduled on drawings.
    b. Volts: 120.
    c. Phases: Single.
    d. Hertz: 60.

C. Unit Electrical Characteristics:

1. Full-Load Amperes: Per manufacturer's specifications.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 22 Section "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. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Division 31 Section "Earth Moving."

3.2 EXAMINATION

A. Examine roughing-in for plumbing piping to verify actual locations of storm drainage piping connections before sump pump installation.

3.3 INSTALLATION

A. Pump Installation Standards: Comply with HI 1.4 for installation of sump pumps.

3.4 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection.
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 motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Pumps and controls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 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.

3.7 ADJUSTING

A. Adjust pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust control set points.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controls and pumps.

END OF SECTION

SECTION 22 34 00

FUEL-FIRED, DOMESTIC-WATER HEATERS

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. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
   2. Domestic-water heater accessories.

1.3 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.

C. Product Certificates: For each type of commercial, gas-fired domestic-water heater, from manufacturer.

D. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

E. Source quality-control reports.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

H. Warranty: Sample of special warranty.

1.4 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/IESNA 90.1 Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. 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.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 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: Three years.
2) Controls and Other Components: One year.

b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. A. O. Smith Corporation.
b. Lochinvar Corporation.

c. Rheem Manufacturing Company.
d. State Industries.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum 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 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Lining: Glass complying with NSF 61 barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

5. 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 or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. 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.

B. Capacity and Characteristics:

1. Capacity: As indicated on drawing schedule.
2. Recovery: As indicated on drawing schedule.
3. Temperature Setting: As indicated on drawing schedule.
4. Fuel Gas Input: As indicated on drawing schedule.
5. Gas Pressure Regulator:

a. Capacity: As indicated on drawing schedule.
b. Inlet Pressure: 7” water column.
c. Gas Pressure Required at Burner: Maximum 14” water column.

6. Electrical Characteristics:

a. Volts: 120.
b. Phase: Single.
c. Hertz: 60.
d. Full-Load Amperes: See manufacturer's specifications.

7. Minimum Vent Diameter: See manufacturer's specifications.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. A. O. Smith Corporation.
b. AMTROL Inc.
c. Bell & Gossett; a Xylem brand.
d. State Industries.
e. Taco, Inc.

2. 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.
3. 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 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

4. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig.
b. Capacity Acceptable: As indicated on drawing schedule.
c. Air Pre-charge Pressure: 50 psig.

B. Heat-Trap Fittings: ASHRAE 90.2.

C. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

D. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 2-psig pressure rating as required to match gas supply.

E. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

F. 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.

G. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

H. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.3 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 Division 01 Section "Quality Requirements" for retesting and re-inspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 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 Division 03 Section.

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. Tankless, Domestic-Water Heater Mounting: Install tankless, domestic-water heaters at least 18 inches above floor on wall bracket.

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.

C. 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 Division 22 Section "General-Duty Valves for Plumbing Piping."

D. 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.

E. 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.

F. 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 Division 22 Section "Domestic Water Piping Specialties."

G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

H. Fill domestic-water heaters with water.

I. Charge domestic-water compression tanks with air to match facility’s incoming water pressure.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Division 22 Section "Domestic Water Piping."

B. Drawings indicate general arrangement of piping, fittings, and specialties.

C. 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.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 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 Division 01 Section "Quality Requirements" for re-testing and re-inspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 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 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.02 RELATED SECTIONS

A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc..

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; Institute of Electrical and Electronic Engineers.

C. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.

D. NFPA 70 - National Electrical Code; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 25 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors and their accessories, with minimum five years documented product development, testing, and manufacturing experience.

B. Conform to applicable electrical codes and NFPA 70.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., or testing firm acceptable to the authority having jurisdiction, as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:
   1. Refer to Section 26 27 17 for required electrical characteristics.
   2. Voltage and phase as scheduled.

B. Construction:
   1. Open drip-proof type except where specifically noted otherwise.
   2. Design for continuous operation in 40 degrees C environment.
   3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   4. Provide drive rated motors when the motor is fed through a variable frequency drive.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:
   1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
   2. For fractional horsepower motors where connection is made directly, provide conduit connection in end frame.

2.02 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.

B. Single phase motors for shaft mounted fans or blowers: Electronically Commutated type. capacitor type.

C. Motors installed indoors in a dry environment and not subject to condensation or sprayed water shall be the open, drip-proof type.

D. Motors installed outdoors, or in wet locations, or as indicated in schedules on the drawings, shall be totally enclosed, non-ventilated, or totally enclosed fan-cooled.

2.03 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.04 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.05 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.06 SINGLE PHASE POWER – ELECTRONICALLY COMMUTATED MOTORS

A. Motor enclosures: Open type

B. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.

C. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.

D. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.

E. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.

F. Motor shall be a minimum of 85% efficient at all speeds.

2.06 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors imbedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter.

I. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

J. Sound Power Levels: To NEMA MG 1.

K. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

L. Weatherproof Epoxy Sealed or Treated Motors: Epoxy seal windings using vacuum and pressure or coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

D. Locate the motor nameplate to be visible after installation.

END OF SECTION

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof Curbs

B. Equipment rails

C. Wind restraints

1.02 SUMMARY

A. All rooftop equipment shall be restrained to resist wind forces. Restraints shall maintain equipment in place.

B. Installation of roof mounted equipment shall comply with the requirements of section 1600 of the North Carolina Building Code.

C. Provide delegated design of wind restraints.

1.03 RELATED SECTIONS

A. Section 01 45 16 - Field Quality Control Procedures.

B. Section 01 45 33 - Code-Required Special Inspections and Procedures.

1.04 REFERENCES

A. ASCE 7 - Minimum Design Loads For Buildings and Other Structures.

1.05 DELEGATED DESIGN

A. Wind Load Certification and Analysis:

1. Provide delegated design of wind restraints.

2. Submit calculations by the Restraint Manufacturer's licensed Engineer substantiating the mounting system, wind restraints and fasteners for approval along with the shop drawings. Wind loads shall have calculations based on the local design wind load conditions. Restraints shall be designed and selected to meet the wind loading requirements as defined in the latest issue of the North Carolina Building Code and ASCE-7. A registered professional engineer having a PE from the same state as the project, or state of restraint manufacturer shall stamp all analysis, or as required by local building codes.

1.06 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide schedule of restraint type with location and load on each.

C. Shop Drawings for wind restraints:

1. For each scheduled piece of equipment that requires wind restraint, submit restraint system and supporting calculations sealed by an Engineer registered in in the state where the work is being performed.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Amber-Booth: www.amberbooth.com.

B. Loos & Co, Inc.: www.earthquakebrace.com.

C. Mason Industries: www.mason-ind.com.

D. Vibration Eliminator: www.veco-ny.com.

E. Cooper B-Line: www.b-line.com.

F. Kinetics Noise Control: www.kineticsnoise.com.

G. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOF CURBS AND EQUIPMENT RAILS

A. Wind Roof Curbs and Equipment Rails:
   1. Rooftop equipment shall be mounted on wind rated curbs or equipment rails.
   2. Curbs and rails shall provide continuous support for the equipment and must have positive fastening provisions (welding or bolting) to anchor equipment to the curb or rail.
   3. Curbs and rails shall be designed for positive anchorage or welding of equipment to supports and welding or bolting of supports to the building steel, capable of resisting design wind forces.
   4. Curbs and rails shall be designed for watertight installation in accordance with roofing manufacturer's requirements.
   5. In roof curbs, provide acoustical package consisting of perimeter angle and cross-members on floating member to support two layers of 5/8" waterproof sheetrock laid with staggered joints. This acoustical barrier shall be caulked to minimize sound transmission. A four inch thick layer of 1.5 density fiberglass shall cover the entire roof surface under unit.

B. Wind Rated, Vibration Isolation Roof Curbs:
   1. When scheduled, install roof top units on wind rated vibration isolation curbs equal to ThyCurb Vibro-Curb III..
   2. Curbs shall provide wind restraining for the conditions in which the project is located.
   3. Curbs shall provide vibration isolation for rooftop units. Minimum spring deflection shall be 3".
   4. Curb Construction: Prefabricated Vibration isolation curb to be manufactured of prime galvanized steel construction, 18 or 14 gauge as required, meeting ASTM A653/653M, with welded corners and with seams joined by continuous water and air tight welds. Vibration isolation curb shall be internally reinforced with bulkheads 48" on center and factory installed wood nailer. Top of all Vibration isolation curb shall be level, with pitch built into curb when deck slopes. Vibration isolation curb shall be designed to provide a minimum of 90% isolation efficiency with 1" deflection. 9" continuous rubber cover around perimeter of Vibration isolation curb over spring isolators.
   5. Provide acoustical package consisting of perimeter angle and cross-members on floating member to support two layers of 5/8" waterproof sheetrock laid with staggered joints. This acoustical barrier shall be caulked to minimize sound transmission. A four inch thick layer of 1.5 density fiberglass shall cover the entire roof surface under unit. Mechanical Contractor shall notify Engineer one week prior to closing in the assembly to allow Engineer to inspect curb, insulation and drywall assembly.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Notify Engineer one week prior to closing in the curb assembly to allow Engineer to inspect acoustic barrier assembly (curb, insulation and drywall assembly).

END OF SECTION

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of:
   1. Air systems.

B. Measurement of final operating condition of HVAC systems.

C. Sound measurement of equipment operating conditions.

D. Work of this Section is in the Division 23 Contract.

1.02 REFERENCES

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Submit qualifications for approval including:
   1. Name of testing, adjusting and balancing agency.
   2. Qualifications of supervisor to be one of the following:
      a. AABC certified test and balance engineer.
      b. NEBB certified testing, balancing and adjusting supervisor.

C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
   1. Submit under provisions of Section 01 40 00.
   2. Submit to the Architect/Engineer, Construction Manager, and HVAC Controls Contractor within two weeks after completion of testing, adjusting, and balancing.
   3. Revise TAB plan to reflect actual procedures and submit as part of final report.
   4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
   5. Provide reports in letter size PDF format, complete with index page and indexing tabs, with cover identification at front and side.
   6. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
   7. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
   8. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
   9. Units of Measure: Report data in both I-P (inch-pound).
   10. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms, forms prepared following ASHRAE Std 111 or NEBB forms.
   11. Include the following on the title page of each report:
      a. Name of Testing, Adjusting, and Balancing Agency.

b. Address of Testing, Adjusting, and Balancing Agency.
c. Telephone number of Testing, Adjusting, and Balancing Agency.
d. Name of TAB Supervisor.
e. Project name.
f. Project location.
g. Project Architect.
h. Project Engineer.
i. Project Contractor.
j. Project altitude.
k. Report date.

D. Project Record Documents: Record actual locations of flow measuring stations, balancing valves and other balancing devices.

1.04 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC MN-1, ASHRAE Std 111, or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

B. TAB Agency Qualifications: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years experience certified by AABC.

C. Perform Work under supervision of AABC Certified Test and Balance Engineer or NEBB Certified Testing, Balancing and Adjusting Supervisor.

1.05 SEQUENCING AND SCHEDULING

A. Sequence work to commence after completion of systems and schedule completion of work before Substantial Completion of Project.

B. Schedule and provide assistance in final adjustment and test of life safety systems, smoke evacuation systems, and smoke control systems.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 TESTING, ADJUSTING, AND BALANCING AGENCIES

A. The Phoenix Agency, Inc.

B. Air Balance Corporation.

C. Test & Balance Corporation.

D. Research Air Flo, Inc.

E. Palmetto Air & Water Balance.

F. M&M Test and Balance.

G. e-n Tech.

H. Submit substitutions under the provisions of section 016000.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.

B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

B. Provide additional balancing devices as required.

3.04 INSTALLATION TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus or minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. Cross reference diffusers with the location in the final report.

F. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

G. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

H. Where actual measurements recorded for the final balance show deviation of more than the specified tolerance from the design, and the deviation cannot be corrected by balancing with the installed layout and elements, note this deviation in the final report with recommendations for corrective action.

I. In those cases where recorded data can be reasonably interpreted to be inaccurate, inconsistent or erroneous, the Engineer may request additional testing and balancing. The TAB Contractor shall, at no additional cost to the Owner, perform such retesting and rebalancing as directed by and in the presence of the Engineer.

J. Where, in the opinion of the TAB Contractor, there is excessive vibration, movement or noise from any piece of equipment, ductwork, or piping, these conditions should be noted in the final report with recommendations for action.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet. The design documents may be used for this.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

3.07 SCOPE

A. When included in project, test, adjust, and balance the following:
   1. Roof Top Units
   2. Kitchen hoods and make up air units
   3. Fans
   4. Air Filters
   5. Air Inlets and Outlets

3.08 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
   1. Manufacturer
   2. Model/Frame
   3. HP/BHP
   4. Phase, voltage, amperage; nameplate, actual, no load
   5. RPM
   6. Service factor
   7. Starter size, rating, heater elements
   8. Sheave Make/Size/Bore

B. V-Belt Drives:
   1. Identification/location
   2. Required driven RPM
   3. Driven sheave, diameter and RPM

4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

C. Air Moving Equipment:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual
8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM

D. Return Air/Outside Air:
1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

E. Exhaust Fans:
1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual
6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

F. Duct Traverses:
1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure

9. Air temperature
10. Air correction factor

G. Air Distribution Tests:
1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

H. Sound Level Reports:
1. Location
2. Octave bands - equipment off
3. Octave bands - equipment on

END OF SECTION

SECTION 23 07 13

DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Insulation jackets.

1.02 RELATED SECTIONS

A. Section 23 31 00 - HVAC Ducts and Casings.

1.03 REFERENCES

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).

C. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

D. ASTM C 553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

E. ASTM C 612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

F. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials.

G. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

H. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association.

I. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc..

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage. Store in original wrapping.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period as recommended by manufacturer.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, and UL 723.

2.02 GLASS FIBER, FLEXIBLE, TYPE A

A. Manufacturer:
   1. Knauf Fiber Glass: www.knaufinsulation.us.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C 553; flexible, noncombustible blanket.
   1. 'K' value: 0.29 at 75 degrees F, when tested in accordance with ASTM C 518.
   2. Maximum Service Temperature: 250 degrees F.
   3. Maximum Water Vapor Sorption: 2.0 percent by weight.
   4. Density: 3/4 lb./cu. ft.

C. Vapor Barrier Jacket:
   1. Kraft paper with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.
   3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Manufacturers: As recommended by insulation manufacturer.
   2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:
   1. Manufacturers: As recommended by insulation manufacturer.
   2. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gage.

2.03 GLASS FIBER, RIGID, TYPE B

A. Manufacturer:
   1. Knauf Fiber Glass: www.knaufinsulation.us.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C 612; rigid, noncombustible board.

1. 'K' value: 0.28 at 75 degrees F, when tested in accordance with ASTM C 518.
2. Maximum service temperature: 250 degrees F.
3. Maximum Water Vapor Sorption: 3.0 percent by weight.
4. Density: 3.0 lb/cu ft.

C. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E 96/E 96M.
3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
1. Manufacturers: As recommended by insulation manufacturer.
2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:
1. Manufacturers: As recommended by insulation manufacturer.
2. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
3. Vinyl emulsion type acrylic, compatible with insulation, white color.

2.04 JACKETS

A. Canvas Jacket, Type I: UL listed 8 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.
1. Lagging Adhesive:
a. Manufacturers: As recommended by insulation manufacturer.

B. Compatible with insulation. Aluminum Jacket, Type III: ASTM B 209.
1. Thickness:
a. Largest Duct Dimension 3' or Less: .024" thick.
b. Largest Duct Dimension Greater Than 3' Feet: .032" thick.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
a. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. All ducts conveying air below ambient temperature:
1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. All ducts conveying air above ambient temperature:
1. Provide with standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with caulked aluminum jacket with seams located on bottom side of horizontal duct section.

F. External Duct Insulation Application:
   1. Secure insulation with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

G. Compression of Insulation:
   1. Installed insulation shall not be compressed to be less than 75% of nominal thickness.

3.03 DUCTWORK INSULATION SCHEDULE

A. Schedule:

	Thickness	Type	Jacket
Supply Duct - Concealed	2"	A	None
Supply Duct - Exposed	2"	B	I
Supply and Return ducts installed outdoors	2"	B	III
Supply sound attenuators	1.5”	B	None
Return Duct - Interior Concealed with Roof Above	2"	A	None
Return Duct - Interior Concealed with second floor above	None		
Exhaust Duct	None		

B. When noted on plans to apply gypsum board to supply sound attenuators, apply 1.5” thick type B insulation with FSK vapor barrier. Then apply one layer of 5/8” thick gypsum board using stainless steel sheet metal screws.

END OF SECTION

SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED SECTIONS

A. Section 07 84 00 - Firestopping.

B. Section 09 90 00 - Painting and Coating.

C. Section 23 05 53 - Identification for HVAC Piping and Equipment.

D. Section 23 21 13 - Hydronic Piping.

1.03 REFERENCES

A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.

B. ASTM C 195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.

C. ASTM C 449/C 449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.

D. ASTM C 518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

E. ASTM C 534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

F. ASTM C 547 - Standard Specification for Mineral Fiber Pipe Insulation.

G. ASTM C 585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

H. ASTM C 795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

I. ASTM D 1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber.

J. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.

K. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

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.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Store insulation in original wrapping and protect from weather and construction traffic.

C. Protect insulation against dirt, water, chemical and mechanical damage.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum period as recommended by manufacturers.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, and UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION, TYPE E

A. Manufacturer:
   1. AP Armaflex by Armacell LLC: www.armacell.us/home.
   2. FlexTherm by Nomanco: www. nomaco.com.
   3. Insul-Tube by K-Flex USA: www. Kflexusa.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 1; use molded tubular material wherever possible.
   1. 'K' Value: 0.28 at 75 degrees F when tested in accordance with ASTM C177.
   2. Minimum Service Temperature: -40 degrees F.
   3. Maximum Service Temperature: 220 degrees F.
   4. Maximum Flame Spread: ASTM E84; 25.
   5. Maximum Smoke Developer: ASTM E84; 50.
   6. Connection: Waterproof vapor barrier adhesive.
   7. Maximum Moisture Absorption: 0.2% by volume.
   8. Water Vapor Permeability: 0.08 perm/inch when tested in accordance with ASTM E 96.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves and flexible connections.

D. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

E. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

3.03 PIPING INSULATION SCHEDULE

A. Cooling System: Provide vapor barrier.

Piping System	Pipe Size (Inches)	Insulation Thickness (Inches)	Type
Cold condensate drain	All	0.5	E
Refrigerant Suction Piping installed outdoors	All	1.5	E
Refrigerant Suction Piping installed indoors	All	0.75	E

B. Finish:
1. Finish elastomeric insulation installed outdoors with UV resistant coating per the recommendations of the insulation manufacturer.

END OF SECTION

SECTION 23 09 23

DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - General

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Related Sections

A. Section 230993 - sequence of operation

B. Section 262717 - equipment wiring

1.3 References

A. All work shall conform to the following Codes and Standards:
   1. Applicable State and local codes.
   2. Underwriters Laboratories (UL) listing and labels.
   3. UL 268 Smoke Detectors for Fire Alarm Signaling Systems
   4. UL 916 Energy Management Equipment
   5. NFPA 70 - National Electrical Code.
   6. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.
   7. ANSI/ASHRAE Standard 135-2004 BACnet-A Data Communication Protocol for building Automation and control Networks

1.4 Standard Terms

A. Standard
   1. ASHRAE: American Society Heating, Refrigeration, Air Conditioning Engineers
   2. AHU: Air Handling Unit
   3. BACnet: Building Automation Controls Network
   4. BMS: Building Management System
   5. DDC: Direct Digital Control
   6. EIA: Electronic Industries Alliance
   7. GUI: Graphical User Interface
   8. HVAC: Heating, Ventilation, and Air Conditioning
   9. IEEE: Institute Electrical Electronic Engineers
   10. MER: Mechanical Equipment Room
   11. PID: Proportional, Integral, Derivative

B. Communications and protocols
   1. ARP: Address Resolution Protocol
   2. CORBA: Common Object Request Broker Architecture
   3. CSMA/CD: Carrier Sense Multiple Access/Collision Detect
   4. DDE: Dynamic Data Exchange
   5. FTT: Free Topology Transceivers
   6. HTTP: Hyper Text Transfer Protocol

7. IIOP: Internet Inter-ORB Protocol
8. LAN: Local Area Network
9. LON: Echelon Communication – Local Operating Network
10. MS/TP: Master Slave Token Passing
11. ODBC: Open Database Connectivity
12. ORB: Object Request Broker
13. SNVT: Standard Network Variables Types
14. SQL: Structured Query Language
15. UDP: User Datagram Protocol
16. XML: eXtensible Markup Language

C. Controllers
1. ASD: Application Specific Device
2. AAC: Advanced Application Controller
3. ASC: Application Specific Controller.
4. CAC: Custom Application Controller.
5. DCU: Distributed Control Unit
6. LCM: Local Control Module
7. MC: MicroControllers
8. MCI: MicroInterface
9. MN-II: Microzone II direct digital controller
10. MN-FLO: Micronet 2000 Pressure Independent VAV Controller
11. NSC: Network Server Controller
12. PEM: Package Equipment Module
13. PPC: Programmable Process Controller
14. SDCU: Standalone Digital Control Units
15. SLC: Supervisory Logic Controller
16. UEC: Unitary Equipment Controller
17. VAVDDC: Variable Air Volume Direct Digital Controller

D. Tools and Software
1. AMBCx: Automated Monitoring Based Commissioning
2. APEO: Automated Predictive Energy Optimization
3. DR: Demand Response
4. CCDT: Configuration, Commissioning and Diagnostic Tool
5. BPES: BACnet Portable Engineering Station
6. LPES: LON Portable Engineering Station
7. POT: Portable Operator’s Terminal
8. PEMS: Power and Energy Management Software

1.5 Qualifications of Controls Contractor

A. All bidders must be building automation contractors in the business of installing direct digital control building automation systems for a minimum of 3 years.
B. The Building Management System contractor shall have a full service facility within 100 miles of the project that is staffed with engineers trained and certified by the manufacturer in the configuration, programming and service of the automation system. The contractor’s technicians shall be fully capable of providing instructions and routine emergency maintenance service on all system components.

1. Any installing contractor, not listed as prequalified in the Approved Manufacturer's section, shall submit credentials as detailed in the Pre-bid Submittal section for the engineer's review 2 weeks prior to bid date. Failure to follow the attached formats shall disqualify potential alternate bidders. Credentials must attest that the contractor meets all requirements of the specification and the Engineers judgment regarding approval to bid as an acceptable installer after reviewing the data will be final.

C. Bidders must be authorized distributors or branch offices of the manufacturers specified.

D. The following bidders have been pre-qualified:
   1. Schneider Electric
   2. Hoffman Building Technologies, installing Allerton products.
   3. Delta Controls Partner located within 100 miles of the project site, installing Delta Controls products with BACnet protocol.
   4. Other providers will not be considered.

E. Alternate 1: For the base bid, provide pricing from one of the three pre-qualified bidders. For Alternate 1, provide pricing to provide HVAC controls by Schneider Electric.

1.6 Scope of Work

A. The Contractor shall furnish and install a complete building automation system including all necessary hardware and all operating and applications software necessary to perform the control sequences of operation as called for in this specification. All components of the system – workstations, servers, application controllers, unitary controllers, etc. shall communicate using the BACnet protocol, as defined by ASHRAE Standard 135-2007l. The only exception will be field controllers within the Schneider Electric I/NET and NETWORK 8000 family. No gateways shall be used for communication to controllers furnished under this section. At a minimum, provide controls for the following:
   1. DX Roof Top units
   2. Type 1 grease hoodsKitchen make up air units
   3. Exhaust fans
   4. Domestic hot water circulating pumps.Electric Wall Heaters
   5.
   6. Power wiring to DDC devices and BAS panels except as otherwise specified.

B. Schneider Electric Enterprise Server software is existing on virtual server within Brunswick County Schools domain. The control system for this project must connect to the existing Schneider Electric Enterprise server. Graphical user interface screens must be added for this site/project to the existing system navigation infrastructure. Graphical interface screens must enable the owner to read/write values from the StruxureWare front end to the HVAC control system installed for this project. Read and write functionality from StruxureWare front end must include (but not limited to) the following: Complete scheduling functionality (global schedules from StruxureWare front end with default schedules at local control system), space setpoint manipulation and set point manipulation of all new mechanical equipment including RTUs, exhaust fans, etc. Extended trend logs and alarm data as it pertains to this project must also be configured within the StruxureWare Enterprise Server.

C. Except as otherwise noted, the control system shall consist of all necessary Ethernet Network Controllers, Standalone Digital Control Units, workstations, software, sensors, transducers, relays, valves, dampers, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the

specification and provide for a complete and operable system. Except as otherwise specified, provide operators for equipment such as dampers if the equipment manufacturer does not provide these. Coordinate requirements with the various Contractors.

D. The BAS contractor shall review and study all HVAC drawings and the entire specification to familiarize themselves with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc. to be provided.
E. All interlocking wiring, power wiring and installation of control devices associated with the equipment listed below shall be provided under this Contract. Controls contractor shall provide all high and low voltage power wiring required to make the controls system functional. Power wiring shall be taken from designated breakers.
F. When the BAS system is fully installed and operational, the BAS Contractor and representatives of the Owner will review and check out the system – see System Acceptance and Testing section of this document. At that time, the BAS contractor shall demonstrate the operation of the system and demonstrate that it complies with the intent of the drawings and specifications.
G. Provide services and manpower necessary for commissioning of the system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative.
H. All work performed under this section of the specifications will comply with all governing codes, laws and governing bodies.
I. The Contractor shall obtain and pay for all necessary construction permits and licenses.
J. Rooftop units and other equipment will be equipped with BACnet interfaces. Obtain information as required for integrating these units into the BAS from the M.C. and/or equipment supplier.

1.7 System Description

A. Provide a BACnet based, HVAC control system to serve new equipment installed in this project.
B. Provide a graphical, web-based, operator interface that allows for access to any system through a standard browser.
C. Provide a PC-based programming/operator workstation of modular design providing distributed processing capability, and allowing future expansion of both input/output points and processing/control functions.

   The system shall consist of the following components:

   1. Ethernet-based Network Router and/or Network Server Controller(s): The BAS Contractor shall furnish Ethernet-based Network Server Controllers as described in Part 2 of the specification. These controllers will connect directly to the Operator Workstation over Ethernet at a minimum of 100mbps, and provide communication to the Standalone Digital Control Units and/or other Input/Output Modules. Network Server Controllers shall conform to BACnet device profile B-BC. Network controllers that utilize RS232 serial communications or ARCNET to communicate with the workstations will not be accepted.

      Network Controllers shall be tested and certified by the BACnet Testing Laboratory (BTL) as Network Server Controllers (B-BC).
   2. Standalone Digital Control Units (SDCUs): Provide the necessary quantity and types of SDCUs to meet the requirements of the project for mechanical equipment control. Each SDCU will operate completely standalone, containing all of the I/O and programs to control its associated equipment. Each BACnet protocol SDCU shall conform to the BACnet device profile B-AAC.

BACnet SDCUs shall be tested and certified by the BACnet Testing Laboratory (BTL) as Advanced Application Controllers (B-AAC).

D. The Local Area Network (LAN) shall be either a 10 or 100 Mpbs Ethernet network supporting BACnet, Modbus, Java, XML, HTTP, and CORBA IIOP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Server Controllers (NSCs), user workstations and a local host computer system.
E. The Enterprise Ethernet (IEEE 802.3) LAN shall utilize Carrier Sense Multiple/Access/Collision Detect (CSMA/CD), Address Resolution Protocol (ARP) and User Datagram Protocol (UDP) operating at 10 or 100 Mbps.
F. The system shall enable an architecture that utilizes a MS/TP selectable 9.6-76.8 KBaud protocol, as the common communication protocol between all controllers and integral ANSI / ASHRAE™ Standard 135-2008, BACnet functionality to assure interoperability between all system components. The AAC shall be capable of communicating as a MS/TP device or as a BACnet IP device communicating at 10/100 Mbps on a TCP/IP trunk. The ANSI / ASHRAE™ Standard 135-2008, BACnet protocol is required to assure that the project is fully supported by the leading HVAC open protocol to reduce future building maintenance, upgrade, and expansion costs.
G. The software tools required for network management of the LonTalk™ protocol and the ANSI / ASHRAE™ Standard 135-2008, BACnet protocol must be provided with the system. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans and are required to meet the functional intent, shall be provided without additional cost to the Owner. Minimum BACnet compliance is Level 4; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet IP or MS/TP. Physical connection of LonWorks devices shall be via Ethernet IP or FTT-10A.
H. The system shall support Modbus TCP and RTU protocols natively, and not require the use of gateways.
I. The field bus shall support the use of wireless communications.
J. Complete temperature control system to be DDC with electronic sensors and electronic/electric actuation of dampers and actuators as specified herein. The BAS is intended to seamlessly connect devices throughout the building regardless of subsystem type, i.e. variable frequency drives, low voltage lighting systems, electrical circuit breakers, power metering and card access should easily coexist on the same network channel.
    1. The supplied system must incorporate the ability to access all data using Java and HTML5 enabled browsers without requiring proprietary operator interface and configuration programs.
    2. Data shall reside on a supplier-installed server for all database access.
    3. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer’s internal Intranet network.
K. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the approved manufacturer's local field office. Supervision, hardware and software engineering, calibration and checkout of the system shall be by the employees of the approved manufacturer's local field office and shall not be subcontracted. The control contractor shall have an in place support facility within 100 miles of the site with factory certified technicians and engineers, spare parts inventory and all necessary test and diagnostic equipment for the installed system, and the control contractor shall have 24 hours/day, 7 days/week emergency service available.

L. Provide the Commissioning, configuration and diagnostic tool (CCDT), color display personnel computer, software, and interfaces to provide uploading/downloading of High Point Count Controllers (AAC) and Unitary Equipment Controllers (UEC) monitoring all BACnet objects, monitoring overrides of all controller physical input/output points, and editing of controller resident time schedules.
M. Provide a Portable Operator's Terminal (POT) color display personnel computer, software, and interfaces to provide uploading/downloading of Custom Application Controller and Application Specific Controllers databases, monitoring of all LonMark™ Standard Network Variables Types (SNVTs) including display of all bound SNVTs, monitoring and overrides of all controller physical input/output points, and editing of controller resident time schedules. POT connectivity shall be via digital wall sensor connected to controller.

1.8 Work by Others

A. The BAS Contractor shall cooperate with other contractors performing work on this project necessary to achieve a complete and neat installation. To that end, each contractor shall consult the drawings and specifications for all trades to determine the nature and extent of others' work.
B. The BAS Contractor shall provide field supervision to the designated contractor for the installation of the following:
    1. Automatic control dampers
    2. Blank-off plates for dampers that are smaller than duct size.
    3. Sheet metal baffles plates to eliminate stratification.
    4. The Electrical Contractor will be subcontracted by the Controls Contractor to provide:
        a. All power wiring to junction boxes for power to BAS panels.
        b. Furnish smoke detectors and wire to the building fire alarm system. HVAC Contractor to mount devices. BAS Contractor to hardwire to fan shut down.

1.9 Code Compliance

A. Provide BAS components and ancillary equipment, which are UL-916 listed and labeled.
B. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.
C. All wiring shall conform to the National Electrical Code.
D. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
E. Comply with FCC, Part 68 rules for telephone modems and data sets.

1.10 Submittals

A. Submit per the requirements of Section 013000 - Administrative Requirements.
B. Submit shop drawings of the control system consisting of a list of equipment and materials, including manufacturers catalog data sheets and installation instructions, wiring and schematic diagrams and software descriptions.
C. Submit samples of typical graphic screens.
D. Drawings shall be B size or larger.

E. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typicals will be allowed where appropriate.
F. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.
G. Software submittals shall contain narrative descriptions of sequences of operation, program listings, point lists, and a complete description of the graphics, reports, alarms and configuration to be furnished with the workstation software. Information shall be in PDF format with bookmarks. Diagrams shall be 11” by 17”size. If color has been used to differentiate information, the printed copies shall be in color.
H. Submit PDFs of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. .
I. The following is a list of post construction submittals that shall be updated to reflect any changes during construction and re-submitted as “As-Built”.
    1. System architecture drawing.
    2. Layout drawing for each control panel
    3. Wiring diagram for individual components
    4. System flow diagram for each controlled system
    5. Instrumentation list for each controlled system
    6. Sequence of control
    7. Binding map
    8. Operation and Maintenance Manuals
J. Information common to the entire system shall be provided. This shall include but not be limited to the following.
    1. Product manuals for the key software tasks.
    2. Operating the system.
    3. Administrating the system.
    4. Engineering the operator workstation.
    5. Application programming.
    6. Engineering the network.
    7. Setting up the web server.
    8. Report creation.
    9. Graphics creation.
    10. All other engineering tasks.
    11. System Architecture Diagram.
    12. List of recommended maintenance tasks associated with the system servers, operator workstations, data servers, web servers and web clients.
    13. Define the task.
    14. Recommend a frequency for the task.
    15. Reference the product manual that includes instructions on executing the task.
    16. Names, addresses, and telephone numbers of installing contractors and service representatives for equipment and control systems.
    17. Licenses, guarantees, and warranty documents for equipment and systems.
    18. Submit one copy for each building, plus two extra copies.
K. Information common to the systems in a single building shall be provided.
    1. System architecture diagram for components within the building annotated with specific location information.

2. As-built drawing for each control panel.
3. As-built wiring design diagram for all components.
4. Installation design details for each I/O device.
5. As-built system flow diagram for each system.
6. Sequence of control for each system.
7. Binding map for the building.
8. Product data sheet for each component.
9. Installation data sheet for each component.
10. Submit two copies for each building and two extra copies.

L. Software shall be provided:
1. Submit a copy of all software installed on the servers and workstations.
2. Submit all licensing information for all software installed on the servers and workstations.
3. Submit a copy of all software used to execute the project even if the software was not installed on the servers and workstations.
4. Submit all licensing information for all of the software used to execute the project.
5. All software revisions shall be as installed at the time of the system acceptance.
6. Firmware Files
7. Submit a copy of all firmware files that were downloaded to or pre-installed on any devices installed as part of this project.
8. This does not apply to firmware that is permanently burned on a chip at the factory and can only be replaced by replacing the chip.
9. Submit a copy of all application files that were created during the execution of the project.
10. Submit a copy of all graphic page files created during the execution of the project.

1.11 Coordination

A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
B. Coordinate equipment from other divisions including "Fire Alarm" to achieve compatibility with equipment that interfaces with that system.
C. Coordinate with the Owner's IT department on locations for UNC's, Ethernet communication cabling and TCP/IP addresses.

1.12 Ownership

A. The Owner shall retain licenses to software for this project.
B. The Owner shall sign a copy of the manufacturer’s standard software and firmware licensing agreement as a condition off this contractor. Such license shall grant use of all programs and application software to the Owner as defined by the manufacturer’s license agreement, but shall protect the manufacturer’s rights to disclosure of Trade Secrets contained within such software.
C. The licensing agreement shall not preclude the use of the software by individuals under contract to the owner for commissioning, servicing or altering the system in the future. Use of the software by individuals under contract to the owner shall be restricted to use on the owner’s computers and only for the purpose of commissioning, servicing, or altering the installed system.
D. All project developed software, files and documentation shall become the property of the Owner. These include but are not limited to:

1. Server and workstation software
2. Application programming tools
3. Configuration tools
4. Network diagnostic tools
5. Addressing tools
6. Application files
7. Configuration files
8. Graphic files
9. Report files
10. Graphic symbol libraries
11. All documentation

1.13 Quality Assurance - System Startup and Commissioning

A. Each point in the system shall be tested for both hardware and software functionality. In addition, each mechanical and electrical system under control of the BAS will be tested against the appropriate sequence of operation specified herein. A written report will be submitted to the owner indicating that the installed system functions in accordance with the plans and specifications.

B. The BAS contractor shall commission and set in operating condition all major equipment and systems, such as the chilled water, hot water and all air handling systems, in the presence of the equipment manufacturer's representatives, as applicable, and the Owner and Architect's representatives.

C. The BAS Contractor shall provide a technician and engineering services required to assist the HVAC Contractor and Balancing Contractor in testing, adjusting, and balancing all systems in the building. The BAS Contractor shall coordinate all requirements to provide a complete air balance with the Balancing Contractor and shall include all labor and materials in his contract.

D. Startup Testing shall be performed for each task on the startup test checklist, which shall be initialed by the technician and dated upon test was completion along with any recorded data such as voltages, offsets or tuning parameters. Any deviations from the submitted installation plan shall also be recorded.

E. Required elements of the startup testing include:
    1. Measurement of voltage sources, primary and secondary
    2. Verification of proper controller power wiring.
    3. Verification of component inventory when compared to the submittals.
    4. Verification of labeling on components and wiring.
    5. Verification of connection integrity and quality (loose strands and tight connections).
    6. Verification of bus topology, grounding of shields and installation of termination devices.
    7. Verification of point checkout.
    8. Each I/O device is landed per the submittals and functions per the sequence of control.
    9. Analog sensors are properly scaled and a value is reported
    10. Binary sensors have the correct normal position and the state is correctly reported.
    11. Analog outputs have the correct normal position and move full stroke when so commanded.
    12. Binary outputs have the correct normal state and respond appropriately to energize/de-energize commands.

13. Documentation of analog sensor calibration (measured value, reported value and calculated offset).
14. Documentation of Loop tuning (sample rate, gain and integral time constant).

F. A performance verification test shall also be completed for the operator interaction with the system. Test elements shall be written to require the verification of all operator interaction tasks including, but not limited to the following.
1. Graphics navigation.
2. Trend data collection and presentation.
3. Alarm handling, acknowledgement and routing.
4. Time schedule editing.
5. Application parameter adjustment.
6. Manual control.
7. Report execution.
8. Automatic backups.
9. Web Client access.

G. A Startup Testing Report and a Performance Verification Testing Report shall be provided upon test completion.

1.14 Warranty and Maintenance

A. All components, system software, and parts furnished and installed by the BAS contractor shall be guaranteed against defects in materials and workmanship for 1 year of substantial completion. Labor to repair, reprogram, or replace these components shall be furnished by the BAS contractor at no charge during normal working hours during the warranty period. Materials furnished but not installed by the BAS contractor shall be covered to the extent of the product only. Installation labor shall be the responsibility of the trade contractor performing the installation. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 standard working hours.

1.15 Training

A. The BAS Contractor shall provide both on-site and classroom training to the Owner’s representative and maintenance personnel per the following description:

B. On-site training shall consist of a minimum of 16 hours of hands-on instruction geared at the operation and maintenance of the systems. The curriculum shall include
1. System Overview
2. System Software and Operation
3. System access
4. Software features overview
5. Changing setpoints and other attributes
6. Scheduling
7. Editing programmed variables
8. Displaying color graphics
9. Running reports
10. Workstation maintenance
11. Viewing application programming

12. Operational sequences including start-up, shutdown, adjusting and balancing.
13. Equipment maintenance.

PART 2 - Products

2.1 System Architecture

A. General
1. The Building Automation System (BAS) shall consist of Network Server/Controllers (NSCs), a family of Standalone Digital Control Units (SDCUs), Administration and Programming Workstations (APWs), and Web-based Operator Workstations (WOWs). The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable.
2. An Enterprise Level BAS shall consist of an Enterprise Server, which enables multiple NSCs (including all graphics, alarms, schedules, trends, programming, and configuration) to be accessible from a single Workstation simultaneously for operations and engineering tasks.
3. The Enterprise Level BAS shall be able to host up to 250 servers, or NSCs, beneath it.
4. For Enterprise reporting capability and robust reporting capability outside of the trend chart and listing ability of the Workstation, a Reports Server shall be installed on a Microsoft Windows based computer. The Reports Server can be installed on the same computer as the Enterprise Server.
5. The system shall be designed with a top-level 10/100bT Ethernet network, using the BACnet/IP protocol.
6. Modbus RTU/ASCII (and J-bus), Modbus TCP, BACnet MS/TP, BACnet IP, LonTalk FTT-10A, and WebServices shall be native to the NSCs. There shall not be a need to provide multiple NSCs to support all the network protocols, nor should there be a need to supply additional software to allow all three protocols to be natively supported. A sub-network of SDCUs using the BACnet MS/TP protocol shall connect the local, stand-alone controllers with Ethernet-level Network Server Controllers/IP Routers.

B. TCP/IP Level
1. The TCP/IP layer connects all of the buildings on a single Wide Area Network (WAN) isolated behind the campus firewall. Fixed IP addresses for connections to the campus WAN shall be used for each device that connects to the WAN.

C. Fieldbus Level with Standalone Digital Control Units (SDCUs)
1. The fieldbus layer shall support all of the following types of SDCUs:
   a. BACnet SDCU requirements: The system shall consist of one or more BACnet MS/TP field buses managed by the Network Server Controller. Minimum speed shall be 76.8kbps. The field bus layer consists of an RS485, token passing bus that supports up to 127 Standalone Digital Control Units (SDCUs) for operation of HVAC and lighting equipment. These devices shall conform to BACnet standard 135-2007. The NSCs shall be capable of at least two BACnet MS/TP field buses for a total capability of 254 SDCUs per NSC.

D. BAS LAN Segmentation
1. The BAS shall be capable of being segmented, through software, into multiple local area networks (LANs) distributed over a wide area network (WAN).

Workstations can manage a single LAN (or building), and/or the entire system with all portions of that LAN maintaining its own, current database.

E. Standard Network Support
1. All NSCs, Workstation(s) and Servers shall be capable of residing directly on the owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NSC's, Workstation(s), and Server(s) shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.

F. System Expansion
1. The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same TCP/IP level and fieldbus level controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.
2. Web-based operation shall be supported directly by the NSCs and require no additional software.
3. The system shall be capable of using graphical and/or line application programming language for the Network Server Controllers.

G. Support For Open Systems Protocols
1. All Network Server Controllers must natively support the BACnet IP, BACnet MS/TP, LonWorks FTT-10, Modbus TCP, Modbus RTU (RS-485 and RS-232), and Modbus ASCII protocols.

2.2 Operator Workstation Requirements

A. General
1. The operator workstation portion of the BAS shall consist of one or more full-powered configuration and programming workstations, and one or more web-based operator workstations. For this project provide a minimum of 10 concurrent operator users and/or 2 concurrent engineering users within the enterprise server.
2. The programming and configuration workstation software shall allow any user with adequate permission to create and/or modify any or all parts of the NSC and/or Enterprise Server database.
3. All configuration workstations shall be personal computers operating under the Microsoft Windows operating system. The application software shall be capable of communication to all Network Server Controllers and shall feature high-resolution color graphics, alarming, trend charting. It shall be user configurable for all data collection and data presentation functions.
4. A minimum of 1 Workstation shall be allowed on the Ethernet network. In this client/server configuration, any changes or additions made from one workstation will automatically appear on all other workstations since the changes are accomplished to the databases within the NSC. Systems with a central database will not be acceptable.

B. Administration/Programming Workstation & Enterprise Server Requirements
1. The Enterprise Server/workstation shall consist of the following:
a. Processor

a) Minimum: 2.0 GHz
b) Recommended: 2.6 GHz or higher

b. Memory
a) Minimum: 4GB
b) Recommended: 4GB or higher

c. Operating systems:
a) Microsoft Windows 7 32-bit (Professional, Enterprise, or Ultimate)
b) Microsoft Windows 7 64-bit (Professional, Enterprise, or Ultimate)
c) Microsoft Windows 8.1 32-bit (Pro, Pro N, Enterprise, or Enterprise N)
d) Microsoft Windows 8.1 64-bit (Pro, Pro N, Enterprise, or Enterprise N)
e) Microsoft Windows Server 2008 R2 64-bit (Standard, Enterprise, Datacenter, Web, or Itanium)
f) Microsoft Windows Server 2012 64-bit (Standard, Datacenter, Essentials, or Foundation)
g) Microsoft Windows Server 2012 R2 64-bit (Standard, Datacenter, Essentials, or Foundation)

d. 10/100MBPS Ethernet NIC
e. 250 GB hard disk
f. Required additional software:
a) Microsoft .Net 4.5
g. License agreement for all applicable software

C. Web-Based Operator PC Requirements
1. Any user on the network can access the system, using the following software:
a. Internet Explorer 11
b. Mozilla Firefox
c. Java Version 7.0 (32-bit)
d. Google Chrome

D. General Administration and Programming Workstation Software
1. System architecture shall be truly client server in that the Workstation shall operate as the client while the NSCs shall operate as the servers. The client is responsible for the data presentation and validation of inputs while the server is responsible for data gathering and delivery.
2. The workstation functions shall include monitoring and programming of all DDC controllers. Monitoring consists of alarming, reporting, graphic displays, long term data storage, automatic data collection, and operator-initiated control actions such as schedule and setpoint adjustments.
3. Programming of SDCUs shall be capable of being done either off-line or on-line from any operator workstation. All information will be available in graphic or text displays stored at the NSC. Graphic displays will feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system. All operator functions shall be selectable through a mouse.

E. User Interface:
1. The BAS workstation software shall allow the creation of a custom, browser-style interface linked to the user when logging into any workstation. Additionally, it shall be possible to create customized workspaces that can be assigned to user groups. This interface shall support the creation of “hot-spots” that the user may link to view/edit any object in the system or run any object editor or configuration tool contained in the software. Furthermore, this interface must be able to be

configured to become a user's "PC Desktop" – with all the links that a user needs to run other applications. This, along with the Windows user security capabilities, will enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the BAS software, but may also limit what a user can do on the PC and/or LAN/WAN. This might be used to ensure, for example, that the user of an alarm monitoring workstation is unable to shutdown the active alarm viewer and/or unable to load software onto the PC.

2. System shall be able to automatically switch between displayed metric vs. imperial units based on the workstation/webstations localization.
3. Webstations shall have the capability to automatically re-direct to an HTTPS connection to ensure more secure communications.
4. Personalized layouts and panels within workstations shall be extended to webstations to ensure consistent user experiences between the two user interfaces.
5. Servers and clients shall have the ability to be located in different time zones, which are then synchronized via the NTP server.

F. User Security

1. The software shall be designed so that each user of the software can have a unique username and password. This username/password combination shall be linked to a set of capabilities within the software, set by and editable only by, a system administrator. The sets of capabilities shall range from View only, Acknowledge alarms, Enable/disable and change values, Program, and Administer. The system shall allow the above capabilities to be applied independently to each and every class of object in the system. The system must allow a minimum of 256 users to be configured per workstation. Additionally, the software shall enable the ability to add/remove users based upon Microsoft Windows Security Domains that enable the customer IT department to assist in user access.

G. Configuration Interface

1. The workstation software shall use a familiar Windows Explorers style interface for an operator or programmer to view and/or edit any object (controller, point, alarm, report, schedule, etc.) in the entire system. In addition, this interface shall present a "network map" of all controllers and their associated points, programs, graphics, alarms, and reports in an easy to understand structure. All object names shall be alphanumeric and use Windows long filename conventions.
2. The configuration interface shall also include support for user defined object types. These object types shall be used as building blocks for the creation of the BAS database. They shall be created form the base object types within the system input, output, string variables, setpoints, etc., alarm algorithms, alarm notification objects, reports, graphics displays, schedules, and programs. Groups of user defined object types shall be able to be set up as a predefined aggregate of subsystems and systems. The configuration interface shall support copying/pasting and exporting/importing portions of the database for additional efficiency. The system shall also maintain a link to all "child" objects created. If a user wishes to make a change to a parent object, the software shall ask the user if he/she wants to update all of the child objects with the change.

H. Color Graphic Displays

1. The system shall allow for the creation of user defined, color graphic displays for the viewing of mechanical and electrical systems, or building schematics. These

graphics shall contain point information from the database including any attributes associated with the point (engineering units, etc.). In addition operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse.

2. Requirements of the color graphic subsystem include:
   a. At a minimum, the user shall have the ability to import .gif, .png, .bmp, .jpeg, .tif, and CAD generated picture files as background displays, and layering shall be possible.
   b. The system shall support both Java and HTML5 enabled graphics.
   c. It shall be possible for the user to use JavaScript to customize the behavior of each graphic.
   d. The editor shall use Scalable Vector Graphics (SVG) technology.
   e. A built-in library of animated objects such as dampers, fans, pumps, buttons, knobs, gauges, ad graphs which can be “dropped” on a graphic through the use of a software configuration “wizard”. These objects shall enable operators to interact with the graphic displays in a manner that mimics their mechanical equivalents found on field installed control panels.
   f. Using the mouse, operators shall be able to adjust setpoints, start or stop equipment, modify PID loop parameters, or change schedules.
   g. Status changes or alarm conditions must be able to be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.
   h. Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators must be able to change from one graphic to another by selecting an object with a mouse - no menus will be required.
   i. It shall be possible to create and save graphical components and JavaScript code in reusable and transferrable, customized libraries.
   j. Graphics should rescale based on whatever monitor or viewing device is being used.
   k. Be able to create graphics on varying layers the can be moved and repeated.
   l. Be able to create graphics within varying window panes that can be moved and/or re-referenced. For example, creating the graphical menu within a pane and referencing it on every graphics page, therefore not rebuilding thus allowing for a single spot for updates that get pushed to all the pages that reference it.
3. Additionally, the Graphics Editor portion of the Engineering Software shall provide the following capabilities:
   a. Create and save pages.
   b. Group and ungroup symbols.
   c. Modify an existing symbol.
   d. Modify an existing graphic page.
   e. Rotate and mirror a symbol.
   f. Place a symbol on a page.
   g. Place analog dynamic data in decimal format on a page.
   h. Place binary dynamic data using state descriptors on a page.
   i. Create motion through the use of animated .gif files or JavaScript.
   j. Place test mode indication on a page.
   k. Place manual mode indication on a page.

l. Place links using a fixed symbol or flyover on a page.
m. Links to other graphics.
n. Links to web sites.
o. Links to notes.
p. Links to time schedules.
q. Links to any .exe file on the operator work station.
r. Links to .doc files.
s. Assign a background color.
t. Assign a foreground color.
u. Place alarm indicators on a page.
v. Change symbol/text/value color as a function of an analog variable.
w. Change a symbol/text/value color as a function of a binary state.
x. Change symbol/text/value as a function of a binary state.
y. All symbols used by Schneider Electric EcoBuilding Business in the creation of graphic pages shall be saved to a library file for use by the owner.

I. Automatic monitoring
1. The software shall allow for the automatic collection of data and reporting from any controller or NSC. The frequency of data collection shall be user-configurable.

J. Alarm Management
1. The software shall be capable of accepting alarms directly from NSCs or controllers, or generating alarms based on evaluation of data in controllers and comparing to limits or conditional equations configured through the software. Any alarm (regardless of its origination) will be integrated into the overall alarm management system and will appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, or reports.
2. Alarm management features shall include:
a. A minimum of 1000 alarm notification levels at the NSC, workstation, and webstation levels. At the Enterprise level the minimum number of active and viewable alarms shall be 10,000. Each notification level will establish a unique set of parameters for controlling alarm display, distribution, acknowledgment, keyboard annunciation, and record keeping.
b. Automatic logging in the database of the alarm message, point name, point value, source device, timestamp of alarm, username and time of acknowledgement, username and time of alarm silence (soft acknowledgement).
c. Playing an audible sound on alarm initiation or return to normal.
d. Sending an email page to anyone specifically listed on the initial occurrence of an alarm. The ability to utilize email paging of alarms shall be a standard feature of the software integrated with the operating system’s mail application interface (MAPI). No special software interfaces shall be required and no email client software must be running in order for email to be distributed. The email notification shall be able to be sent to an individual user or a user group.
e. Individual alarms shall be able to be re-routed to a user at user-specified times and dates. For example, a critical high temp alarm can be configured to be routed to a Facilities Dept. workstation during normal working hours (7am-6pm, Mon-Fri) and to a Central Alarming workstation at all other times.
f. An active alarm viewer shall be included which can be customized for each user or user type to hide or display any alarm attributes.

g. The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of user actions for certain alarms.
h. The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of causes for certain alarms. This ensures accountability (audit trail) for the response to critical alarms.
i. The active alarm viewer can be configured such that an operator must confirm that all of the steps in a check list have been accomplished prior to acknowledging the alarm.
j. The active alarm viewer shall, if filtered, show the quantity of visible and total number of alarms that are not equal to 'normal' and the quantity of disabled and hidden alarms.
k. An operator shall have the capability to assign an alarm to another user of the system.
l. Time schedules shall be able to be used to set control notifications to users.

K. Report Generation

1. The Reports Server shall be able to process large amounts of data and produce meaningful reports to facilitate analysis and optimization of each installation.
2. Reports shall be possible to generate and view from the operator Workstation, and/or Webstation, and/or directly from a reports-only web interface.
3. A library of predefined automatically generated reports that prompt users for input prior to generation shall be available. The properties and configurations made to these reports shall be possible to save as Dashboard reports, so that the configurations are saved for future used.
4. It shall be possible to create reports standard tools, such as Microsoft Report Builder 2.0 or Visual Studio, shall be used for customized reports.
5. Additional reports or sets of reports shall be downloadable, transferrable, and importable
6. All reports shall be able to be set up to automatically run or be generated on demand.
7. Each report shall be capable of being automatically emailed to a recipient in Microsoft Word, Excel, and/or Adobe .pdf format.
8. Reports can be of any length and contain any point attributes from any controller on the network.
9. Image management functionality shall be possible to enable the system administrators to easily upload new logos or images to the system.
10. It shall be possible to run other executable programs whenever a report is initiated.
11. Report Generator activity can be tied to the alarm management system, so that any of the configured reports can be displayed in response to an alarm condition.
12. Minimum supplied reports shall include:
    a. Activities Per Server Report
    b. Activities Per User Report
    c. Alarm Amount by Category Report
    d. Alarm Amount by Type Report
    e. Alarms Per Sever Report
    f. Current Alarm Report
    g. Most Active Alarm Report
    h. System Errors Per Server Report

i. Top Activities Report
j. Top Alarms Report
k. Top System Errors Report
l. Trend Log Comparison Report
m. User Logins Report
n. Users and Groups Reports

13. Minimum Energy Reports shall include:
    a. Energy Monitoring Calendar Consumption Report: Shall provide an interactive report that shows the energy usage on one or multiple selected days.
    b. Energy Monitoring Consumption Breakdown Report: Shall provide a report on energy consumption broken down using sub-metering.
    c. Energy Monitoring Consumption Report: Shall show the energy consumption against a specified target value.

L. Scheduling
1. From the workstation or webstation, it shall be possible to configure and download schedules for any of the controllers on the network.
2. Time of day schedules shall be in a calendar style and viewable in both a graphical and tabular view.
3. Schedules shall be programmable for a minimum of one year in advance.
4. To change the schedule for a particular day, a user shall simply select the day and make the desired modifications.
5. Additionally, from the operator webstations, each schedule will appear on the screen viewable as the entire year, monthly, week and day. A simple mouse click shall allow switching between views. It shall also be possible to scroll from one month to the next and view or alter any of the schedule times.
6. Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be automatically updated to the corresponding schedule in the controller.
7. It shall be possible to assign a lead schedule such that shadow/local schedules are updated based upon changes in the Lead.
8. It shall be possible to assign a list(s) of exception event days, dates, date ranges to a schedule.
9. It shall be possible to view combined views showing the calendar and all prioritized exemptions on one screen.
10. It should accommodate a minimum of 16 priority levels.
11. Values should be able to be controlled directly from a schedule, without the need for special program logic.

M. Programmer's Environment
1. Programming in the NSC shall be either in graphical block format or line-programming format or both.
2. Programming of the NSC shall be available offline from system prior to deployment into the field. All engineering tasks shall be possible, except, of course, the viewing of live tasks or values.
3. The programmer's environment will include access to a superset of the same programming language supported in the SDCUs.
4. NSC devices will support both script programming language as well as the graphical function block programming language. For both languages, the

programmer will be able to configure application software for custom program development, and write global control programs. Both languages will have debugging capabilities in their editors.

5. It shall be possible to save custom programs as libraries for reuse throughout the system. A wizard tool shall be available for loading programs from a library file in the program editor.
6. It shall be possible to view graphical programming live and real-time from the Workstation.
7. The system shall be capable of creating 'binding templates' allowing the user to bind multiple points to multiple objects all at once.
8. Key terms should appear when typing (IntelliType).
9. Applications should be able to be assigned different priorities and cycle times for a prioritized execution of different function.
10. The system shall be able to create objects that allow common objects such as power meters, VFD drives, etc. to be integrated into the system with simple import actions without the need of complicated programming or configuration setups.

N. Saving/Reloading

1. The workstation software shall have an application to save and restore NSC and field controller memory files.
2. For the NSC, this application shall not be limited to saving and reloading an entire controller – it must also be able to save/reload individual objects in the controller. This allows off-line debugging of control programs, for example, and then reloading of just the modified information.

O. Audit Trail

1. The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.
2. It shall be possible to view a history of alarms, user actions, and commands for any system object individually or at least the last 5000 records of all events for the entire system from Workstation.
3. It shall be possible to save custom filtered views of event information that are viewable and configurable in Workstation.
4. It shall be capable to search and view all forced values within the system.

P. Fault Tolerant Enterprise Server Operation (Top level NSC)

1. A single component failure in the system shall not cause the entire system to fail. All system users shall be informed of any detectable component failure via an alarm event. System users shall not be logged off as a result of a system failure or switchover.

Q. Web-based Operator Software

1. General:
   a. Day-to-day operation of the system shall be accessible through a standard web browser interface, allowing technicians and operators to view any part of the system from anywhere on the network.
   b. The system shall be able to be accessed on site via a mobile device environment with, at a minimum, access to overwrite and view system values.
2. Graphic Displays
   a. The browser-based interface must share the same graphical displays as the Administration and Programming Workstations, presenting dynamic data on

site layouts, floor plans, and equipment graphics. The browser's graphics shall support commands to change setpoints, enable/disable equipment and start/stop equipment.

b. Through the browser interface, operators must be able to navigate through the entire system, and change the value or status of any point in any controller. Changes are effective immediately to the controller, with a record of the change stored in the system database.

3. Alarm Management

a. Systems requiring additional client software to be installed on a PC for viewing the webstation from that PC will not be considered.

b. Through the browser interface, a live alarm viewer identical to the alarm viewer on the Administration and Programming workstation shall be presented, if the user's password allows it. Users must be able to receive alarms, silence alarms, and acknowledge alarms through a browser. If desired, specific operator text must be able to be added to the alarm record before acknowledgement, attachments shall be viewable, and alarm checklists shall be available.

R. Groups and Schedules

1. Through the browser interface, operators must be able to view pre-defined groups of points, with their values updated automatically.
2. Through the browser interface, operators must be able to change schedules – change start and stop times, add new times to a schedule, and modify calendars.

S. User Accounts and Audit Trail

1. The same user accounts shall be used for the browser interface and for the operator workstations. Operators must not be forced to memorize multiple passwords.
2. All commands and user activity through the browser interface shall be recorded in the system's activity log, which can be later searched and retrieved by user, date, or both.

T. Web Services

1. The installed system shall be able to use web services to "consume" information within the Network Server/Controllers (NSCs) with other products and systems. Inability to perform web services within the NSCs will be unacceptable.

a. Shall be able to "consume" data into the system via SOAP and REST web services.

b. Shall be able to "serve" and "consume" data from other Schneider Electric systems such as: StruxureWare Data Center Expert

2.3 Network Server Controllers (NSCs)

A. Network Router Controllers shall combine both network routing functions, control functions, and server functions into a single unit.

B. The BACnet NSC shall be classified as a "native" BACnet device, supporting the BACnet Network Server Controller (B-BC) profile. Controllers that support a lesser profile such as B-SA are not acceptable. NSCs shall be tested and certified by the BACnet Testing Laboratory (BTL) as BACnet Network Server Controllers (B-BC).

C. The Network Server Controller shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NRS.

D. The NSCs shall be capable of whitelisting IPs to restrict access to a pre-defined list of hosts or devices.
E. They shall also be responsible for monitoring and controlling their own HVAC equipment such as an AHU or boiler.
F. They shall also contain graphics, trends, trend charts, alarm views, and other similar presentation objects that can be served to workstations or web-based interfaces. A sufficient number of NSCs shall be supplied to fully meet the requirements of this specification and the attached point list.
G. It shall be capable of executing application control programs to provide:
    1. Calendar functions
    2. Scheduling
    3. Trending
    4. Alarm monitoring and routing
    5. Time synchronization by means of an Internet site including automatic synchronization
    6. Native integration of LonWorks controller data and Modbus controller data or BACnet controller data and Modbus controller data
    7. Network Management functions for all LonWorks based devices
H. Hardware Specifications
    1. Memory:
        a. The operating system of the controller, application programs, and all other portions of the configuration database, shall be stored in non-volatile, FLASH memory. Servers/Controllers shall contain enough memory for the current application, plus required history logging, plus a minimum of 20% additional free memory.
    2. Each NRC shall provide the following on-board hardware for communication:
        a. One 10/100bT Ethernet for communication to Workstations, other NRCs and onto the Internet
        b. Two RS-485 ports for communication to BACnet MSTP bus or serial Modbus (software configurable)
        c. One TP/FT port for communication to LonWorks devices.
        d. One Device USB port
        e. Two host USB Ports
    3. The NSC shall conform to a small footprint no larger than 100W x 125H x 75D mm (3.94W x 4.92H x 2.95D in).
I. Modular Expandability:
    1. The system shall employ a modular I/O design to allow expansion. Input and output capacity is to be provided through plug-in modules of various types. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.
    2. One shall be able to “hot-change” (hot-swap) the I/O modules preserving the system on-line without any intervention on the software; addressing and configuration shall be automatic.
    3. If for any reason the backplane of the modular I/O system were to fail, I/O module addresses will be protected.
J. Hardware Override Switches:
    1. All digital outputs shall, optionally, include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of

the override switch can be obtained through software. In addition each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

K. Universal Input Temperatures
   1. All universal inputs directly connected to the NSC via modular expansion shall be capable of using the following thermistors for use in the system without any external converters needed.
      1) 10 kohm Type I (Continuum)
      2) 10 kohm Type II (I/NET)
      3) 10 kohm Type III (Satchwell)
      4) 10 kohm Type IV (FD)
      5) Linearized 10 kohm Type V (FD w/11k shunt)
      6) Linearized 10 kohm (Satchwell)
      7) 1.8 kohm (Xenta)
      8) 1 kohm (Balco)
      9) 20 kohm (Honeywell)
      10) 2.2 kohm (Johnson)
   2. In addition to the above, the system shall be capable of using the below RTD sensors, however it is not required that all universal inputs be compatible with them.
      1) PT100 (Siemens)
      2) PT1000 (Sauter)
      3) Ni1000 (Danfoss)

L. Local Status Indicator Lamps:
   1. The NSC shall provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each input or output, provide LED indication of the value of the point (On/Off). The LED indication shall support software configuration to set whether the illumination of the LED corresponds to On or Off or whether the color when illuminated is Red or Green.

M. Real Time Clock (RTC):
   1. Each NSC shall include a battery-backed, real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. Each NSC will allow for its own UTC offset, depending upon the time zone. When the time zone is set, the NSC will also store the appropriate times for daylight savings time.

N. Power Supply:
   1. The 24 VDC power supply for the NSCs shall provide 30 watts of available power for the NSC and associated IO modules. The system shall support the use of more than one power supply if heavily power consuming modules are required.
   2. The power supply, NSC, and I/O modules shall connect power wise and communication wise via the separate terminal base allowing for ease of replacement and no separate or loose wiring.

O. Automatic Restart After Power Failure:
   1. Upon restoration of power after an outage, the NSC shall automatically and without human intervention update all monitored functions, resume operation based on current, synchronize time and status, and implement special start-up strategies as required.

P. Battery backup:

1. The NSC shall include an on-board battery to back up the controller's RAM memory. The battery shall provide accumulated backup of all RAM and clock functions for at least 30 days. In the case of a power failure, the NSC shall first try to restart from the RAM memory. If that memory is corrupted or unusable, then the NSC shall restart itself from its application program stored in its FLASH memory.

Q. Software Specifications

1. The operating system of the controller, application programs, and all other portions of the configuration database such as graphics, trends, alarms, views, etc., shall be stored in non-volatile, FLASH memory. There will be no restrictions placed on the type of application programs in the system. Each NSC shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.
2. Each NSC shall have an available capacity of 4 GB of memory. This shall represent 2 GB for application and historical data and 2 GB dedicated for backup storage.

R. User Programming Language:

1. The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be either a script-based structured text or graphical function block based and fully programmable by the user. The language shall be structured to allow for the configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, and histories. Users shall be able to place comments anywhere in the body of either script or function block programs.
2. Network Server Controllers that use a "canned" program method will not be accepted.

S. Control Software:

1. The NSC shall have the ability to perform the following pre-tested control algorithms:
   a. Proportional, Integral plus Derivative Control (PID)
   b. Two Position Control
   c. Digital Filter
   d. Ratio Calculator
   e. Equipment Cycling Protection

T. Mathematical Functions:

1. Each controller shall be capable of performing basic mathematical functions (+, -, *, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.

U. NSCs shall have the ability to perform any or all of the following energy management routines:

1. Time of Day Scheduling
2. Calendar Based Scheduling
3. Holiday Scheduling
4. Temporary Schedule Overrides

5. Optimal Start
6. Optimal Stop
7. Night Setback Control
8. Enthalpy Switchover (Economizer)
9. Peak Demand Limiting
10. Temperature Compensated Duty Cycling
11. CFM Tracking
12. Heating/Cooling Interlock
13. Hot/Cold Deck Reset
14. Hot Water Reset
15. Chilled Water Reset
16. Condenser Water Reset
17. Chiller Sequencing

V. History Logging:

1. Each NSC controller shall be capable of LOCALLY logging any input, output, calculated value or other system variable either over user defined time intervals ranging from 1 second to 1440 minutes or based upon a user configurable change of value. A minimum of 1000 logs, with a minimum of 100,000 records, shall be stored. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logged data shall be downloadable to a higher level NSC long term archiving based upon user-defined time intervals, or manual command.
2. For extended trend logging a minimum of 1500 trends shall be capable, with a minimum number of 600,000 records within.
3. Management of a power meter replacement to ensure meter log data is accurate shall be possible in the NSC.
4. Every hardware input and output point, hosted within the NSC and attached I/O modules, shall be trended automatically without the requirement for manual creation, and each of these logs shall log values based upon a change of value and store at least 500 trend samples before replacing the oldest sample with new data.
5. The presentation of logged data shall be built into the server capabilities of the NSC Presentation can be in time stamped list formats or in a chart format with fully configurable pen colors, weights, scales and time spans.

W. Alarm Management:

1. For each system point, alarms can be created based on high/low limits or in comparison to other point values. All alarms will be tested each scan of the NSC and can result in the display of one or more alarm messages or reports.
2. There is no limit to the number of alarms that can be created for any point
3. Alarms can be configured to be generated based upon a single system condition or multiple system conditions.
4. Alarms will be generated based on an evaluation of the alarm conditions and can be presented to the user in a fully configurable order, by priority, by time, by category, etc. These configurable alarm views will be presented to a user upon logging into the system regardless of whether the log in takes place at a WorkStation or a Webstation.
5. The alarm management system shall support the ability to create and select cause and action notes to be selected and associated with an alarm event. Checklists shall also be possible in order to present to an operator a suggested mode of

troubleshooting. When acknowledging an alarm, it shall be possible to assign it to a user of the system such that the user is notified of the assignment and is made responsible for the alarm resolution.

6. Alarms must be capable of being routed to any BACnet workstation that conforms to the B-OWS device profile and uses the BACnet/IP protocol.

X. Embedded Web Server

1. Each NSC must have the ability to serve out web pages containing the same information that is available from the WorkStation. The development of the screens to accomplish shall not require any additional engineering labor over that required to show them at the WorkStation itself.

2.4 BACnet Fieldbus and BACnet SDCUs

A. Networking

1. IP Network: All devices that connect to the WAN shall be capable of operating at 10 megabits per second or 100 megabits per second.
2. IP To Field Bus Routing Devices
   a. A Network Server Controller shall be used to provide this functionality.
   b. These devices shall be configurable locally with IP crossover cable and configurable via the IP network.
   c. The routing configuration shall be such that only data packets from the field bus devices that need to travel over the IP level of the architecture are forwarded.

B. Field Bus Wiring and Termination

1. The wiring of components shall use a bus or daisy chain concept with no tees, stubs, or free topology.
2. Each field bus shall have a termination resistor at both ends of each segment.
3. The field bus shall support the use of wireless communications.

C. Repeaters

1. Repeaters are required to connect two segments.
2. Repeaters shall be installed in an enclosure. The enclosure may be in an interstitial space.

D. Field Bus Devices

1. General Requirements
   a. Devices shall have a light indicating that they are powered.
   b. Devices shall be locally powered. Link powered devices (power is furnished from a central source over the field bus cable) are not acceptable.
   c. Application programs shall be stored in a manner such that a loss of power does not result in a loss of the application program or configuration parameter settings. (Battery backup, flash memory, etc.)

E. Network Server Controllers (NSCs)

   a. If NSCs have embedded I/O, all of the requirements for I/O that are described under Advance Application Controllers shall apply.
   b. Shall support the export of data to NSCs from other vendors that support the data sharing, read property service.
   c. Shall support the export of data using Change of Value (COV) initiation to NSCs from other vendors that support the subscription to data using the COV concept.

d. Shall support the export of data to any BACnet OWS that supports the data sharing, read property service.
e. Shall support the export of data using Change of Value (COV) initiation to any BACnet OWS that supports the subscription to data using the COV concept.
f. Shall provide trend log support for all of the devices on the field bus. They shall provide sufficient memory to store up to 300 samples for each variable required to be trended by the sequence of control.
g. Shall support the exporting of trend log data to any BACnet OWS that supports the read range BACnet service for trending.
h. Shall provide time schedule support for all of the devices on the field bus.
i. Shall support the editing of time schedule entries from any BACnet OWS that supports the BACnet service for writing of time schedule parameters.
j. Shall provide alarm message initiation for all alarms conditions from any of the field bus devices.
k. Shall deliver alarm messages to any BACnet OWS that supports the BACnet service for receiving alarm messages and is configured to be a recipient of the notification.
l. Shall support alarm acknowledgement from any BACnet OWS that supports the BACnet service for executing alarm/event acknowledgement.
m. Shall support the control of the out of service property and assignment of value or state to analog and binary objects from any BACnet OWS that supports writing to the out of service property and the value property of analog and binary objects.
n. Shall support the receipt and response to Time Synchronization commands from any device that supports the BACnet service for initiating time synchronization commands.
o. Shall support the “Who is?” and “I am.” BACnet service.
p. Shall support the “”Who has?” and “I have.” BACnet service.
q. Shall support Backup and Restore commands from any BACnet OWS that supports the initiation of Backup and Restore commands.
r. Shall be BTL certified.

F. Advance Application Controllers (B-AAC)

1. The key characteristics of a B-AAC are:
   a. They have physical input and output circuits for the connection of analog input devices, binary input devices, pulse input devices, analog output devices, and binary output devices. The number and type of input and output devices supported will vary by model.
   b. They may or may not provide support for additional input and output devices beyond the number of circuits that are provided on the basic circuit board. Support for additional I/O shall be provided by additional circuit boards that physically connect to the basic controller.
   c. The application to be executed by a B-AAC is created by an application engineer using the vendor’s application programming tool.
   d. If local time schedules are embedded, the B-AAC shall support the editing of time schedule entries from any BACnet OWS that supports the BACnet service for writing of time schedule parameters.

e. If local trend logging is embedded, the B-AAC shall support the exporting of trend log data to any BACnet OWS that supports the read range BACnet service for trending.
f. If local alarm message initiation is embedded, the B-AAC shall:
   1) Deliver alarm messages to any BACnet OWS that supports the BACnet service for receiving alarm messages and is configured to be a recipient off the alarm message.
   2) Support alarm acknowledgement from any BACnet OWS that supports the BACnet service for executing alarm/event acknowledgement,
g. Shall support the reading of analog and binary data from any BACnet OWS or Building Controller that supports the BACnet service for the reading of data.
h. Shall support the control of the out of service property and assignment of value or state to analog and binary objects from any BACnet OWS that supports writing to the out of service property and the value property of analog and binary objects.
i. Shall support the receipt and response to Time Synchronization commands from a BACnet Building Controller.
j. Shall support the “Who is” and “I am.” BACnet services.
k. Shall support the “Who has” and “I have.” BACnet services.

2. Analog Input Circuits
   a. The resolution of the A/D chip shall not be greater than 0.01 Volts per increment. For an A/D converter that has a measurement range of 0 to 10 VDC and is 10 bit, the resolution is 10/1024 or 0.00976 Volts per increment.
   b. For non-flow sensors, the control logic shall provide support for the use of a calibration offset such that the raw measured value is added to the (+/-) offset to create a calibration value to be used by the control logic and reported to the Operator Workstation (OWS).
   c. For flow sensors, the control logic shall provide support for the use of an adjustable gain and an adjustable offset such that a two point calibration concept can be executed (both a low range value and a high range value are adjusted to match values determined by a calibration instrument).
   d. For non-linear sensors such as thermistors and flow sensors the B-AAC shall provide software support for the linearization of the input signal.
3. Binary Input Circuits
   a. Dry contact sensors shall wire to the controller with two wires.
   b. An external power supply in the sensor circuit shall not be required.
4. Pulse Input Circuits
   a. Pulse input sensors shall wire to the controller with two wires.
   b. An external power supply in the sensor circuit shall not be required.
   c. The pulse input circuit shall be able to process up to 20 pulses per second.
5. True Analog Output Circuits
   a. The logical commands shall be processed by a digital to analog (D/A) converter chip. The 0% to 100% control signal shall be scalable to the full output range which shall be either 0 to 10 VDC, 4 to 20 milliamps or 0 to 20 milliamps or to ranges within the full output range (Example: 0 to 100% creates 3 to 6 VDC where the full output range is 0 to 10 VDC).
   b. The resolution of the D/A chip shall not be greater than 0.04 Volts per increment or 0.08 milliamps per increment.

6. Binary Output Circuits
    a. Single pole, single throw or single pole, double throw relays with support for up to 230 VAC and a maximum current of 2 amps.
    b. Voltage sourcing or externally powered triacs with support for up to 30 VAC and 0.5 amps at 24 VAC.
7. Program Execution
    a. Process control loops shall operate in parallel and not in sequence unless specifically required to operate in sequence by the sequence of control.
    b. The sample rate for a process control loop shall be adjustable and shall support a minimum sample rate of 1 second.
    c. The sample rate for process variables shall be adjustable and shall support a minimum sample rate of 1 second.
    d. The sample rate for algorithm updates shall be adjustable and shall support a minimum sample rate of 1 second.
    e. The application shall have the ability to determine if a power cycle to the controller has occurred and the application programmer shall be able to use the indication of a power cycle to modify the sequence of controller immediately following a power cycle.
8. Local Interface
    a. The controller shall support the connection of a portable interface device such as a laptop computer or vendor unique hand-held device. The ability to execute any tasks other than viewing data shall be password protected. Via this local interface, an operator shall be able to:
        1) Adjust application parameters.
        2) Execute manual control of input and output points.
        3) View dynamic data.

G. Application Specific Devices
1. Application specific devices shall have fixed function configurable applications.
2. If the application can be altered by the vendor's application programmable tool, the device is an advanced application controller and not an application specific device.
3. Application specific devices shall be BTL certified.

2.5 DDC Sensors and Point Hardware

A. Temperature Sensors
1. Acceptable Manufacturers: Veris Industries, Trane
2. All temperature devices shall use precision thermistors accurate to +/- 1 degree F over a range of –30 to 230 degrees F. Space temperature sensors shall be accurate to +/- .5 degrees F over a range of 40 to 100 degrees F.
3. Room Sensor: Standard space sensors shall be available in an off white enclosure made of high impact ABS plastic for mounting on a standard electrical box. Basis of Design: Veris TW Series

    1) Where manual overrides are required, the sensor housing shall feature both an optional sliding mechanism for adjusting the space temperature setpoint, as well as a push button for selecting after hours operation.
    2) Where a local display is specified, the sensor shall incorporate an LCD display for viewing the space temperature, setpoint and other operator

selectable parameters. Using built in buttons, operators shall be able to adjust setpoints directly from the sensor.

4. Duct Probe Sensor: Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Useable in air handling applications where the coil or duct area is less than 14 square feet. Basis of Design: Veris TD Series
5. Duct Averaging Sensor: Averaging sensors shall be employed in ducts which are larger than 14 square feet. The averaging sensor tube shall contain at least one thermistor for every 3 feet, with a minimum tube length of 6 feet. The averaging sensor shall be constructed of rigid or flexible copper tubing. Basis of Design: Veris TA Series
6. Outside Air Sensor: Provide the sensing element on the building's north side. Sensing element shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure. Operating range -40 to 122 F, Basis of Design: Veris TO Series
7. A pneumatic signal shall not be allowed for sensing temperature.

B. Humidity Wall Transmitter
1. Acceptable Manufacturer: Veris Industries, Trane
2. Transmitters shall be accurate to +/- 2 % at full scale.
3. Transmitter shall have replaceable sensing element.
4. Sensor type shall be thin-film capacitive.
5. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
6. Operating range shall be 0 - 100% RH noncondensing, 50 to 95 F
7. Output shall be field selectable 4-20 mA or 0-5/0-10 VDC.
8. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
9. Transmitter shall be available in an off white enclosure made of high impact ABS plastic for mounting on a standard electrical box.
10. Transmitter shall have LCD display
11. Transmitter shall be available with a certification of NIST calibration
12. Transmitter shall have integrated temperature sensor
13. Basis of Design: Veris HWL Series

C. Humidity Duct Transmitter
1. Acceptable Manufacturer: Veris Industries, Trane
2. Transmitters shall be accurate to +/- 2 % at full scale.
3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe.
4. Transmitter shall have replaceable sensing element.
5. Sensor type shall be thin-film capacitive.
6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
8. Output shall be 4-20 mA or 0-5/0-10 VDC.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
10. Transmitter shall be available with a certification of NIST calibration
11. Transmitter shall have integrated temperature sensor
12. Basis of Design: Veris HD Series

D. Humidity Outdoor Transmitter
1. Acceptable Manufacturer: Veris Industries, Trane
2. Transmitters shall be accurate to +/- 2% at full scale.

3. Transmitter shall be fully encapsulated in potting material within a stainless steel probe. Probe shall be encased in PVC solar radiation shield and mounted in a weatherproof enclosure.
4. Transmitter shall have replaceable sensing element.
5. Sensor type shall be thin-film capacitive.
6. Sensor element shall contain multipoint calibration on-board in nonvolatile memory
7. Operating range shall be 0 - 100% RH noncondensing, -40 to 122 F
8. Output shall be 4-20 mA or 0-5/0-10 VDC.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
10. Transmitter shall be available with a certification of NIST calibration
11. Transmitter shall have integrated temperature sensor
12. Basis of Design: Veris HO Series

E. Carbon Dioxide Wall Transmitter:
1. Acceptable Manufacturer: Veris Industries, Trane
2. Sensor type shall be Non-dispersive infrared (NDIR).
3. Accuracy shall be ±30 ppm ±2% of measured value with annual drift of ±10 ppm. Minimum five year recommended calibration interval.
4. Repeatability shall be ±20 ppm ±1% of measured value
5. Response Time shall be <60 seconds for 90% step change
6. Outputs shall be field selectable Analog: 4-20mA or 0-5/0-10VDC**,** Protocol: BACnet**.**
7. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
8. Temperature Range: 32° to 122°F (CO_2 only)
9. Output range shall be programmable 0-2000 or 0-5000 ppm
10. Transmitter shall be available in an off white enclosure for mounting on a standard electrical box.
11. Transmitter shall have LCD display for commissioning and provide additional faceplate to conceal LCD display where occupants may misinterpret CO_2 readings.
12.
13. Basis of Design: Veris CWL

F. Carbon Dioxide Duct Transmitter:
1. Acceptable Manufacturer: Veris Industries, Trane
2. Sensor type shall be Non-dispersive infrared (NDIR).
3. Accuracy shall be ±30 ppm ±2% of measured value with annual drift of ±10 ppm. Minimum five year recommended calibration interval.
4. Repeatability shall be ±20 ppm ±1% of measured value
5. Response Time shall be <60 seconds for 90% step change
6. Outputs shall be field selectable Analog: 4-20mA or 0-5/0-10VDC with SPDT Relay 1A@30VDC
7. Transmitter shall accept 12-30 VDC or 24 VAC supply power.
8. Temperature Range: 32° to 122°F
9. Output range shall be programmable 0-2000 or 0-5000 ppm
10. Enclosure shall not require remote pickup tubes and make use of integrated H-beam probe to channel air flow to sensor.
11. Enclosure lid shall require no screws and make use of snap on features for attachment
12. Enclosure shall be made of high impact ABS plastic
13. Transmitter shall have LCD display

14. Basis of Design: Veris CDL

G. Air Pressure Transmitters.
1. Acceptable Manufacturers: Veris Industries
2. Sensor shall be microprocessor profiled ceramic capacitive sensing element
3. Transmitter shall have 14 selectable ranges from 0.1 – 10" WC
4. Transmitter shall be +/- 1% accurate in each selected range including linearity, repeatability, hysteresis, stability, and temperature compensation.
5. Transmitter shall be field configurable to mount on wall or duct with static probe
6. Transmitter shall be field selectable for Unidirectional or Bidirectional
7. Maximum operating pressure shall be 200% of design pressure.
8. Output shall be field selectable 4-20 mA or 0-5/0-10 VDC linear.
9. Transmitter shall accept 12-30 VDC or 24 VAC supply power
10. Response time shall be field selectable T95 in 20 sec or T95 in 2 sec
11. Transmitter shall have an LCD display
12. Units shall be field selectable for WC or PA
13. Transmitter shall have provision for zeroing by pushbutton or digital input.
14. Transmitter shall be available with a certification of NIST calibration
15. Basis of Design: Veris model PXU.

H. Current Sensors
1. Current status switches shall be used to monitor fans, pumps, motors and electrical loads. Current switches shall be available in split core models, and offer either a digital or an analog signal to the automation system. Acceptable manufacturer is Veris Industries

I. Current Status Switches for Constant Load Devices
1. Acceptable Manufacturer: Veris Industries
2. General: Factory programmed current sensor to detect motor undercurrent situations such as belt or coupling loss on constant loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory.
3. Visual LED indicator for status.
4. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 0.5 A to 175 A.
5. Normally open current sensor output. 0.1A at 30 VAC/DC.
6. Basis of Design: Veris Model H608.

J. Current Status Switches for Constant Load Devices (Auto Calibration)
1. Acceptable Manufacturer: Veris Industries.
2. General: Microprocessor based, self-learning, self-calibrating current switch. Calibration-free status for both under and overcurrent, LCD display, and slide-switch selectable trip point limits. At initial power-up automatically learns average current on the line with no action required by the installer
3. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 2.5 A to 200 A.
4. Display: Backlit LCD; illuminates when monitored current exceeds 4.5A
5. Nominal Trip Point: ±40%, ±60%, or on/off (user selectable)
6. Normally open current sensor output. 0.1A at 30 VAC/DC.
7. Basis of Design: Veris Model H11D.

K. Current Status Switches for Variable Frequency Drive Application
1. Acceptable Manufacturer: Veris Industries.

2. General: Microprocessor controlled, self-learning, self-calibrating current sensor to detect motor undercurrent and overcurrent situations such as belt loss, coupling shear, and mechanical failure on variable loads. Sensor shall store motor current as operating parameter in non-volatile memory. Push-button to clear memory and relearn.
3. Visual LED indicator for status.
4. Alarm Limits: ±20% of learned current in every 5 Hz freq. band
5. Split core sensor, induced powered from monitored load and isolated to 600 VAC rms. Sensor shall indicate status from 1.5 A to 150 A and from 12 to 115 Hz.
6. Normally open current sensor output. 0.1A at 30 VAC/DC.
7. Basis of Design: Veris Model H614.

L. Dampers

1. Automatic dampers, furnished by the Building Automation Contractor shall be single or multiple blade as required. Dampers are to be installed by the HVAC Contractor under the supervision of the BAS Contractor. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the Sheet Metal Contractor.
2. Damper frames are to be constructed of 13 gauge galvanized sheet steel mechanically joined with linkage concealed in the side channel to eliminate noise as friction. Compressible spring stainless steel side seals and acetyl or bronze bearings shall also be provided.
3. Damper blade width shall not exceed eight inches. Seals and 3/8 inch square steel zinc plated pins are required. Blade rotation is to be parallel or opposed as shown on the schedules.
4. For high performance applications, control dampers will meet or exceed the UL Class I leakage rating.
5. Control and smoke dampers shall be Ruskin, or approved equal.
6. Provide opposed blade dampers for modulating applications and parallel blade for two position control.

M. Damper Actuators

1. Damper actuators shall be electronic, and shall be direct coupled over the shaft, without the need for connecting linkage. The actuator shall have electronic overload circuitry to prevent damage. For power-failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing. Non-spring return actuators shall have an external manual gear release to allow positioning of the damper when the actuator is not powered.

PART 3 - Execution

3.1 Contractor Responsibilities

A. General

1. Installation of the building automation system shall be performed by the Contractor or a subcontractor. However, all installation shall be under the personal supervision of the Contractor. The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor.

B. Code Compliance

1. All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations. Should any discrepancy be found between wiring specifications in Division 17 and Division 16, wiring requirements of Division 17 will prevail for work specified in Division 17.

C. Cleanup

1. At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

3.2 Wiring, Conduit, and Cable

A. All wire will be copper and meet the minimum wire size and insulation class listed below:

Wire Class	Wire Size	Isolation Class
Power	12 Gauge	600 Volt
Class One	14 Gauge Std.	600 Volt
Class Two	18 Gauge Std.	300 Volt
Class Three	18 Gauge Std.	300 Volt
Communications	Per Mfr.	Per Mfr.

B. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.

C. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.

D. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 1/2 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit seal-off fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.

E. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.

F. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.

G. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.

H. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.

I. Only glass fiber is acceptable, no plastic.

J. Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS contractor shall submit to the Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

3.3 Hardware Installation

A. Installation Practices for Wiring

B. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
C. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.
D. A true earth ground must be available in the building. Do not use a corroded or galvanized pipe, or structural steel.
E. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.
F. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.
G. Conduit, in non-finished areas where possible, will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction. Exposed conduit will run parallel to or at right angles to the building structure.
H. Wires are to be kept a minimum of three (3) inches from hot water piping.
I. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.
J. Wire will not be allowed to run across telephone equipment areas.

3.4 Installation Practices for Field Devices

A. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.
B. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
C. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
D. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.
E. For building static pressure sensors, the high pressure port shall be inserted into the space via a metal tube. Pipe the low pressure port to the outside of the building.

3.5 Enclosures

A. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
B. FIPs shall contain power supplies for sensors, interface relays and contactors, and safety circuits.
C. The FIP enclosure shall be of steel construction with baked enamel finish; NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.
D. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
E. All outside mounted enclosures shall meet the NEMA-4 rating.

F. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.

3.6 Identification

A. Identify all control wires with labeling tape or sleeves using words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
B. All field enclosures, other than controllers, shall be identified with a Bakelite nameplate. The lettering shall be in white against a black or blue background.
C. Junction box covers will be marked to indicate that they are a part of the BAS system.
D. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
E. All I/O field devices inside FIP's shall be labeled.

3.7 Location

A. The location of sensors is per mechanical and architectural drawings.
B. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.
C. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
D. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

3.8 Software Installation

A. General.
   1. The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.

3.9 Database Configuration.

A. The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.

3.10 Color Graphic Displays.

A. Unless otherwise directed by the owner, the Contractor will provide color graphic displays as depicted in the mechanical drawings for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner.

3.11 Reports.

A. The Contractor will configure a minimum of 4 reports for the owner. These reports shall, at a minimum, be able to provide:
   1. Trend comparison data
   2. Alarm status and prevalence information

3. Energy Consumption data
4. System user data

3.12 Documentation

A. As built software documentation will include the following:
   1. Descriptive point lists
   2. Application program listing
   3. Application programs with comments.
   4. Printouts of all reports.
   5. Alarm list.
   6. Printouts of all graphics
   7. Commissioning and System Startup

3.13 Point to Point Checkout.

A. Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.

3.14 Controller and Workstation Checkout.

A. A field checkout of all controllers and front end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be prepared and submitted to the owner or owner's representative by the completion of the project.

3.15 System Acceptance Testing

A. All application software will be verified and compared against the sequences of operation.
   1.
   2. Packaged Roof Top ControlExhaust fan control
   3. Exhaust fans
   4. Kitchen hood exhaust fans and make up air units
   5. Domestic hot water circulators
B. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.
C. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.
D. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.
E. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the

interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

SECTION 23 09 93

SEQUENCE OF OPERATION

PART 1 GENERAL

SECTION INCLUDES

A. Provide all labor and services to accomplish the sequence specified below.

B. Provide all cabinets, sensors, actuators, wiring, tubing, graphics and software, in addition to all equipment required in order to accomplish the sequence below.

RELATED SECTIONS

A. Section 23 09 23 – Direct Digital Control System for HVAC

PART 2 PRODUCTS – NOT USED.

PART 3 EXECUTION

SEQUENCE OF OPERATION

A. General System Sequences:
   1. System shall include 365 day, 24 hour per day programmable capability with ability to program holidays.
   2. When in occupied mode, mechanical equipment shall be enabled.
   3. When in the unoccupied mode, all equipment shall be normally disabled and shall cycle on only to maintain unoccupied setback temperatures. Provide user adjustable setback temperatures for Winter (set initially at 55°F) and Summer (set initially at 85°F).
   4. Each room thermostat shall be equipped with a button to switch from unoccupied mode to occupied mode. When any of these buttons is depressed, the system shall switch to occupied mode for a user adjustable time period (set initially at 2 hours). After the time period has passed, the system shall return to the unoccupied mode.
   5. Thermostatic controls shall be capable of having a 5°F dead band between the heating and cooling set point.

B. All setpoints are user adjustable by the system operator.

C. Exhaust Fans:
   1. Roof mounted exhaust fans serving toilet rooms and the Nurses Suite:
      a. Exhaust fans operate during occupied hours. Fans are cycled on and off by the BAS. Provide starters or relays as required to control fans.
      b. Provide status by current sensor. Provide an alarm to the BAS if current sensor indicates that the exhaust fan is not operating.
   2. Exhaust fans serving Science Labs, Science Prep Rooms, Art Rooms, Maker Space, Ware-Washing, Custodial 1826 and the Kiln Room:
      a. Exhaust fan shall be on/off with a wall switch located in the space served.
      b. Provide fan status by current sensor. Provide an alarm to the BAS if current sensor indicates that the exhaust fan status does not match the command.
      c. Provide on/off override by the BAS.
   3. Kitchen Grease Hood Exhaust Fans
      a. Kitchen grease hood exhaust fans are on/off by switches located on the hoods.
      b. Provide fan status by current sensor. Provide an alarm to the BAS if current sensor indicates that the exhaust fan status does not match the command.
   4. Ceiling mounted cabinet style exhaust fans serving toilets:
      a. Ceiling mounted cabinet style exhaust fans are on/off with a wall switch.
   5. Ceiling mounted cabinet style exhaust fans serving janitor closets:
      a. Exhaust fan shall be on/off with a wall switch located in the space served.
      b. Provide on/off override by the BAS.

6. Exhaust fan serving Electrical 1319:
    a. Provide a wall mounted thermostat and hand/off/auto switch.
    b. When the HOA switch is in auto, the fan shall cycle on for room temperature above setpoint.
    c. When the HOA switch is in off, the fan shall be off. When the HOA switch is in the on position, the fan shall be on.
    d. Provide fan status by current sensor. Provide an alarm to the BAS if current sensor indicates that the exhaust fan status does not match the command.

D. Unitary Rooftop Units:
1. Controls internal to the rooftop units will control the operation of the units.
2. Space temperature sensors and CO_2 sensors are provided by the RTU manufacturer.
3. The units will be equipped with BACnet communications interfaces. The interface will make available all points that are standard with the manufacturer's standard interface. All points (inputs, outputs, configuration properties) from this interface are to be mapped to the building management system.
4. Provide graphical interface for each unit.
5. Occupied mode: Rooftop units shall cycle on and controls internal to the unit will maintain the space temperature and relative humidity to the user adjustable setpoints. Units will be capable of cooling, dehumidification (cooling with hot gas reheat), CO2 demand controlled ventilation, dry bulb economizing and single zone variable air volume operation.
    a. Space temperature setpoint is by the local setpoint adjuster on the zone temperature sensor. Provide override by the BAS.
    b. Set maximum indoor relative humidity initially to be 55%. Enable the dehumidification feature (cooling with hot gas reheat) in each RTY.
    c. Enable the CO2 demand controlled ventilation in all units except RTU-11 and those listed in the next item. Set maximum indoor CO2 level initially to be 1000 PPM.
    d. Enable the dry bulb economizer. Set the outdoor temperature for economizing initially to be 60°F.
    e. Enable the single zone variable air volume feature in all RTUs except RTU 11.
6. CO2 demand controlled ventilation is disabled in rooftop units 4, 8, 9 and 10. Demand controlled ventilation at these units is by the associated energy recovery ventilator.
7. Unoccupied mode: RTUs are normally off during unoccupied mode. Outside air dampers remain closed. If space temperature rises above the unoccupied setpoint (set initially at 85°F), the unit shall cycle on and cool until the unoccupied space temperature setpoint is satisfied. If space temperature falls below the unoccupied setpoint (set initially at 55°F), the unit shall cycle on and heat until the unoccupied space temperature setpoint is satisfied.
8. Smoke Sequence: Unit(s) shall shut down upon signal from fire alarm system.
9. Morning warmup: During morning warm up, outside air dampers remain closed. The units shall cycle on and heat, cool or dehumidify as needed to bring the space temperature and relative humidity occupied set points.
10. Provide the following control points minimum:

Analog Output
Space temperature setpoint
Space temperature setpoint override
Space temperature
Space relative humidity setpoint
Space relative humidity
Space CO2 setpoint
Space CO2 concentration
Unoccupied heating setpoint
Unoccupied cooling setpoint
Morning warmup setpoint
Outdoor air temperature

Outdoor air humidity
Outdoor air minimum flow or economizer minimum setpoint

Analog Input
Space temperature cooling setpoint input
Space temperature heating setpoint input
Space temperature local setpoint
Morning warmup setpoint temperature
Discharge air temperature
Cooling capacity status
Heat first stage status
Heat second stage status
Reheat capacity status
Supply fan speed command
Outdoor airflow or economizer minimum
Space CO2 concentration
Dehumidification high limit setpoint

Digital Output
Shut down for smoke alarm
Occupied/unoccupied command
Heat cool mode request
Morning warm up command

Digital Input
Filter status
Condensate drain pan high level

E. Energy Recovery Ventilators
1. Install a CO2 sensor in the return duct from the space, upstream of outside air supplies.
2. The energy recovery ventilators respond to indoor CO2 levels.
3. Set indoor maximum CO2 level initially to 1000 PPM. These values are user adjustable.
4. If indoor CO2 level is below setpoint, the ERV is off.
5. If indoor CO2 level rises above setpoint, the ERV shall cycle on with supply and exhaust fans at 50% speed.
6. Indoor CO2 levels shall be sampled every 10 minutes. If after 10 minutes, the indoor CO2 level is still above setpoint, the ERV supply and exhaust fan speeds shall go to 100%.
7. If fans are operating at 100% and CO2 levels fall 100 PPM below setpoint, the fans shall go to 50%. If fans are operating at 50% and CO2 levels fall 100 PPM below setpoint, the ERV shall cycle off.

F. Type I grease hood and make up air units:
1. The kitchen equipment supplier will provide packaged kitchen hoods and make up air units.
2. The hoods will have a manual hood switch to index the interlocked hood exhaust and make-up air units on and off.
3. The make-up air unit is a 100% outside air unit with filters and direct fired heat. A differential pressure switch shall be provided across the filters of the make-up air unit. The BAS shall be alarmed when the pressure drop across the filter exceeds the setpoint.
4. Heating Control: A proportional temperature controller with sensor mounted in the hood supply duct shall be provided. The controller shall modulate the gas control valve to control the supply air leaving temperature to a setpoint of 55 F (adj.). The manufacturer shall provide all required safeties, including an air flow switch.

5. Provide a smoke detector in the make-up air duct. Activation of the smoke detector, an alarm of the hood fire extinguishing system, or a building fire alarm shall shut down the make-up air unit, while the exhaust fan shall remain in operation. Coordinate with the Electrical Contractor and the Hood supplier. Provide a manual switch in the fire panel to override fan operation in fire mode. The Controls Subcontractor shall be responsible for coordinating all control work and shall provide all wiring, relays, switches, etc., for a complete and operational system.
6. Provide the following status points:
   a. Fan status
   b. Fan start/stop
   c. High/Low Temp Alarm

G. Electric Unit Heaters.
1. Unit heaters shall be controlled by local thermostats only.
2. Upon the space temperature falling below the setpoint (60 deg (adj.)), the unit heater shall be energized and remain so until the space temperature has risen above the setpoint.

H. Filters:
1. Provide magnehelic style differential pressure gages across filter banks.
2. Provide filter status (clean/replace) to the BAS. The differential pressure across the filter shall be displayed on the fan coil unit graphic. The differential pressure point for replace status shall be user adjustable.

I. Ductless Mini-Split systems:
1. Units are controlled by controls integral to the units.
2. Provide a separate space temperature sensor in rooms served by these units.
3. Provide space temperature and high temperature alarm to the BAS.

J. Domestic Hot Water System:
1. Provide on/off control for the domestic hot water circulating pump(s) and for the domestic water heater(s).
2. During the unoccupied mode, the water heater(s) and circulating pump(s) are off.
3. The water heater and circulating pump shall cycle on two hours prior to the start of occupied hours. The cycle on start time is user adjustable.
4. Provide user override of timed operation so that Owner may set water heater and circulating pump to operate continuously.

K. Smoke Detector Operation
1. Upon alarm by duct mounted smoke detectors or room smoke detectors, roof top units shall shut down.
2. Smoke detectors and sampling tubes shall be furnished by the electrical contractor for installation by the mechanical contractor. Smoke detectors shall be connected under electrical and installed under the mechanical section of this specification.

L. Fire Alarm Interface
1. The BAS shall shut-down all air handling equipment as required by code upon contact closure by a remote fire alarm relay located adjacent to the BAS control panel. The HVAC equipment shall de-energize based on whether the dedicated smoke detector or the general alarm contact is in alarm. The equipment shall include, but not be limited to the following:
   a. Roof top units

2. The BAS shall monitor fire alarm system via BACnet/IP interface in the fire alarm control panel.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
B. Refrigerant piping.
C. Pipe hangers and supports.

1.02 REFERENCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
   1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

B. American Society of Mechanical Engineers:
   1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
   3. ASME B31.5 - Refrigeration Piping.

C. ASTM International:
   4. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
   5. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

D. American Welding Society:
   1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.
   2. AWS D1.1 - Structural Welding Code - Steel.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
   3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.03 PERFORMANCE REQUIREMENTS

A. Pressure test refrigerant piping using industry accepted methods.

1.04 SUBMITTALS

A. Shop Drawings: Indicate layout of refrigeration piping system, including equipment, critical dimensions, and sizes.
B. Product Data:
   1. Piping: Submit data on pipe materials, fittings, and accessories.
   2. Hangers and Supports: Submit manufacturers catalog information including load capacity.

C. Test Reports: Indicate results of refrigerant leak test.
D. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.
E. Welding Certificates.

PART 2 PRODUCTS

2.01 REFRIGERANT PIPING

A. Copper Tubing: ASTM B280, drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.02 PIPE HANGERS AND SUPPORTS

A. Manufacturers:
   1. B-Line.
   2. Tolco.
   3. PHD.

B. Conform to ASME B31.5.
C. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron Carbon steel, adjustable swivel, split ring.
D. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
E. Vertical Support: Steel riser clamp.
F. Copper Pipe Support: Carbon steel rings, adjustable, copper plated.
G. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

PART 3 EXECUTION

3.01 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
B. Place hangers within 12 inches of each horizontal elbow.
C. Install hangers to allow 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
D. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
E. Where installing several pipes in parallel and at same elevation, provide multiple pipe hangers or trapeze hangers.
F. Prime coat exposed steel hangers and supports in accordance with specifications herein. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

3.02 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

A. Size refrigerant piping at ductless mini-split systems in accordance with the equipment manufacturer’s published instructions.
B. Size refrigerant piping at ducted split systems in accordance with the equipment manufacturer’s published instructions or in accordance with the ASHRAE Refrigeration Handbook.
C. Route piping parallel to building structure and maintain gradient.
D. Install piping to conserve building space, and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Provide sleeve for pipe passing through partitions, walls and floors.
G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
H. Provide access where valves and fittings are not exposed.
I. Arrange refrigerant piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.
J. Flood refrigerant piping system with nitrogen when brazing.
K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
L. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.
M. Insulate piping in accordance with the specifications.
N. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

O. Pressure test refrigeration system.
P. Repair leaks.
Q. Retest until no leaks are detected

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Kitchen hood ductwork.

D. Duct cleaning.

1.02 RELATED SECTIONS

A. Section 09 90 00 - Painting and Coating.

B. Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

C. Section 23 07 13 - Ductwork Insulation.

D. Section 23 33 00 - Ductwork Accessories.

E. Section 23 37 00 - Air inlets and Outlets.

1.03 REFERENCES

A. ASTM A 36 - Structural Steel.

B. ASTM A 90 - Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles.

C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

D. ASTM A 366 - Steel, Sheet, Carbon, Cold Rolled, Commercial Quality.

E. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.

F. ASTM A 525 - General Requirements for Steel Sheet, Zinc- Coated (Galvanized) by the Hot-Dip Process.

G. ASTM A 527 - Steel Sheet, Zinc-Coated (Galvanized) by Hot-Dip Process, Lock Forming Quality.

H. ASTM A 568 - Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.

I. ASTM A 569 - Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip, Commercial Quality.

J. AWS D9.1 - Welding of Sheet Metal.

K. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyestor Chemical Resistant Process Equipment.

L. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

M. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

N. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.

O. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

P. UL 181 - Factory-Made Air Ducts and Connectors.

1.04 PERFORMANCE REQUIREMENTS

A. Variation of duct configuration or sizes is to be incorporated in the shop drawings. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts, or by using equivalent sizes from a Trane Ductulator. Refer to the ASHRAE Handbook of Fundamentals.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Shop Drawings: Indicate duct fitting construction methods, particulars such as gages, sizes, welds, and type of joints prior to start of work for each pressure class of duct construction. Kitchen hood exhaust, lab exhaust and other specialized systems should be addressed separately.

C. Product Data: Provide data for flexible duct, sealant, and flexible connectors.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01 78 00.

B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.07 QUALITY ASSURANCE

A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

1.08 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing the work of this section with minimum five years documented experience.

1.09 REGULATORY REQUIREMENTS

A. Comply with NFPA 90A and NFPA 96 standards.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures during and after installation of duct sealants.

PART 2 - PRODUCTS

2.01 PRESSURE CLASS

A. Construct low pressure supply, return, exhaust, relief and outside air intake ductwork to a 2”, SMACNA pressure class.

2.02 SEALING REQUIREMENTS

A. Seal all ductwork to SMACNA seal Class A.

B. Seal all rectangular ductwork to meet ASHRAE leakage Class 6.

C. Seal all round and flat oval ductwork to meet ASHRAE leakage Class 3.

2.03 MATERIALS

A. Galvanized Steel Ducts: ASTM A525 and ASTM A527 galvanized steel sheet, lock-forming quality, having G60 zinc coating in conformance with ASTM A90.

B. Steel Ducts: ASTM A366, A569, or A568.

C. Flexible Connectors: Flexible connectors shall be installed at all connections between ductwork and fans. Each unit shall be of double thickness, heavy glass fabric, forming a flexible air-tight bellow joint. Joints in all cases where space permits shall be a minimum of six inches in width. All flexible duct connections of fans shall be of Ventglass as made by Vent Fabrics, Inc. of Chicago, Illinois; Duro Dyne "Eurolon" or other type as approved, which has UL approval for operation at 265 degrees F.

D. Insulated Flexible Ducts:
   1. Manufacturers:
      a. ATCO: www.atcoflex.com.
      b. Hart & Cooley: www.hartandcooley.com.
      c. Flexmaster: www.flexmasterusa.com.
      d. Anco Products, Inc.: www.ancoproductsinc.com.
      e. Thermaflex: www.thermaflex.net.
      f. Substitutions under provisions of Section 01600.
   2. Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; polyethylene vapor barrier film.
   3. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.
   4. Maximum Velocity: 4000 fpm (20.3 m/sec).
   5. Temperature Range: -10 degrees F to 160 degrees F (-23 degrees C to 71 degrees C).

E. Stainless Steel Ducts: ASTM A167, Type 304.

F. Fasteners: Rivets, bolts, or sheet metal screws.

G. Sealant: Non-hardening, water resistant, fire resistive, compatible with mating materials; liquid used alone or with tape, or heavy mastic.

H. Hanger Rod: ASTM A36; steel; threaded both ends, threaded one end, or continuously threaded.

2.04 DUCTWORK FABRICATION

A. All supply ductwork between RTUs and supply duct silencers shall be constructed of 16 gage (0.0635” thick) sheet steel. Additional sections of duct shall be constructed of 16 gage steel when noted on plans.

B. Fabricate remaining ductwork and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated. Snap-lock duct construction is not acceptable for medium/high pressure ductwork.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Prefabricated adjustable elbows are not acceptable for medium pressure ductwork.

D. Where rectangular elbows are used, provide turning vanes constructed in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible. Use 45 degree F turning vanes in 45 degree mitered elbows.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

2.05 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
   1. Manufacturers:
      a. Eastern Sheet Metal.
      b. Monroe Metals.
      c. Semco.
      d. McGill.
      e. R.V. Money, Inc.
      f. Spiral Pipe of Texas.
      g. Hamlin Sheet Metal.
      h. Impulse Air.
      i. Substitutions under provisions of Section 01600.

2.06 FABRICATED KITCHEN HOOD EXHAUST DUCTWORK

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.

B. Construct of 0.0598 inch (1.52 mm) carbon steel or 0.0478 inch (1.21 mm) stainless steel, using continuous external welded joints.

2.07 FACTORY MANUFACTURED EXHAUST DUCTWORK SERVING TYPE 1 GREASE HOODS

A. Provide factory built grease duct that is tested and listed by the Underwriters' Laboratories, Inc. (UL 1978) for use with commercial cooking equipment, as described in NFPA-96.

B. The double wall exhaust system shall have a 304 stainless steel inner liner (20 ga minimum) and an aluminized steel outer jacket (double wall & 24 ga minimum). The materials and construction of the modular sections and accessories shall be as specified by the terms of the product's U.L. listing.

C. Ceramic fiber insulation between the inner liner and outer jacket shall be of sufficient thickness to provide a zero clearance rating to combustible and non-combustible construction.

D. This exhaust system shall be designed and installed to be liquid tight and thus prevent leakage of grease and/or grease laden vapors into a building.

E. Inner pipe joints shall be securely connected and sealed with factory supplied over-lapping V-bands and appropriate sealant as specified in the manufacturer's installation instructions.

F. Each system shall be designed to provide access for inspection and cleaning of each change of duct direction, permit drainage of grease residue through a duct section, enable the system to allow for the thermal expansion and allow various types of fire suppression equipment to be integrated into the grease ductwork, as necessary per local code.

G. Products shall comply with section 506 of the North Carolina Mechanical Code. Provide accessories as required for compliance including but not limited to cleanouts and reservoirs.

2.08 DRYER EXHAUST DUCTWORK

A. Duct joints shall not be assembled with sheet metal screws or other fastening means which extend into duct.

B. Each joint shall be reasonably sealed with non-combustible material.

C. Dryer exhaust ducts shall be 24 gage minimum galvanized steel. Ducts shall have smooth interior finish with joints running in direction of air flow.

D. Provide access for duct cleaning at elbows. Removable elbows or access doors (with smooth inside surface) are acceptable.

E. Maintain 6" minimum clearance to combustible materials.

2.09 FABRIC DUCTWORK

A. Functional requirements: non-permeable fabric ductwork system with orifices as indicated on the plans. Manufacturer shall determine the size and quantities of orifices such that the air velocity is 50 fpm or less at the occupied spaces when operating at full cooling airflow.

B. Product must be classified by underwriter's laboratories in accordance with the 25/50 flame spread / smoke developed requirements of nfpa 90-a and ul 2518. Also classified by ul-c (canada) s102.2, bs 5867 part 2, 1980; gb8624-2006. All product sections must be labeled with the logo and classification marking of underwriter's laboratories.

C. Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure and textile permeability, shall be considered and documented.

D. Submittals: provide detailed drawings confirming configuration of textile dispersion system (diameter, lengths, airflow, pressure, and textile permeability). Provide detailed installation instructions for components to be installed. Provide warranty and maintenance documentation.

E. Warranty: provide a 10 year product warranty for products supplied for the fabric portion of this system.

F. Manufacturers:

   a. Ductsox® corporation: www.ductsox.com

   b. Fabric Duct Systems: www.qsox.com

   c. Substitutions subject to the provisions of section 016000.

G. Fabric ductwork shall be constructed with internal retention system consisting of an internal 360 degree hoop system, spaced evenly and close enough to maintain duct shape with no airflow.

H. System shall be installed with a one row track suspension system to include sections of aluminum track, aluminum splice connectors, track endcaps and vertical cable support kits – consisting of a length of galvanized cable with cable connectors.

I. Textile: equal to ductsox DuraTex. Filament/filament twill polyester, fire retardant in accordance with ul 2518. Air permeability: none. Weight: 6.8 oz. /yd2 per astm d3776

J. Textile color – submit color chart to architect for approval.

K. Textile system to be constructed in modular lengths (zippered) with proper radial securing clips along the length of the system. Provide zippered end caps.

L. Orifices – air dispersion and extended throws are accomplished by reinforced orifices and permeable fabric. Reinforced orifices are to be installed to keep the integrity of opening and withstand laundry processes.

M. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct with fasteners supplied by contractor. Inlet connection includes zipper for easy removal / maintenance.

N. Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

O. Textile air diffusers shall be designed from 0.25” water gage minimum to 3.1” maximum, with 0.5” as the standard.

P. Textile air diffusers shall be limited to design temperatures between 0 degrees f and 180 degrees f (-17.8 degrees c and 82 degrees c).

Q. Install suspension system and ductwork in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Duct mounted smoke detectors will be furnished by the Electrical Contractor. This Contractor shall install all duct detectors in the HVAC system.

B. Install in accordance with manufacturer's instructions.

C. Install and seal all ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Joint sealer shall be UL labeled and fire safe.

D. Duct sizes are inside clear dimensions.

E. In all cases where duct sleeves are roughed through walls, floors, or ceilings, they shall be blocked and braced to prevent sagging or crushing occurring during construction. All sleeves shall be caulked with mineral wool or similar fireproof material to form a fire and smoke stop at the floor or fire rated partition. Each sleeve shall contain a minimum of one inch packing.

F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems. Plug pitot tube openings with plugs.

G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

H. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

I. Connect diffusers to low pressure ducts directly or with 3 to 6 feet maximum length of flexible duct held in place with strap or clamp.

J. Connect flexible ducts to metal ducts with draw bands.

K. Grease Hood Exhaust: Provide approved residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for clean out. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed. Provide clean out access every 20 feet of horizontal run, and at every change of direction as needed for access to clean interior of duct. Provide a durable label on each panel with the words “ACCESS PANEL - DO NOT OBSTRUCT” in minimum 1/2" high letters. Access panels in kitchen hood exhaust ducts shall be approved sliding or removable doors with minimum 2 hour rating. Kitchen hood exhaust ducts shall slope not less than 1 inch per foot toward either the hood or approved residue trap.

L. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

M. Galvanized areas that have been damaged by welding shall be coated with corrosion resistant aluminum paint.

N. Provide access panels or doors in ceilings or walls and access doors in ductwork as required for access to items of equipment mounted inside the ducts.

O. All duct joints sealing compounds, glues, mastics and adhesives used on duct construction shall be UL approved and labeled.

P. For ducts passing through rated assemblies, comply with Section 607 of the North Carolina Mechanical Code.

3.02 CLEANING

A. Comply with Section 2, General Requirements of SMACNA Duct Cleanliness for New Construction Guidelines.

B. Comply with the Basic Level of Section 3, Levels of Duct Cleanliness, of SMACNA Duct Cleanliness for New Construction Guidelines.

3.03 SCHEDULES

A. Ductwork Material Schedule:

AIR SYSTEM	MATERIAL
Supply, Return, Relief and Exhaust	Galvanized Steel
Kitchen Hood Exhaust	Carbon Steel (welded), Stainless Steel (Welded) or factory manufactured product
Fume Hood Exhaust	Stainless Steel (Welded)
Outside Air Intake, Combustion Air,	Galvanized Steel
Dryer Exhaust	Galvanized Steel

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers.

C. Duct access doors.

D. Duct test holes.

E. Fire dampers.

F. Flexible duct connections.

G. Volume control dampers.

H. Duct Sound Attenuators

1.02 RELATED SECTIONS

A. Section 23 09 23 - Direct-Digital Control System for HVAC.

B. Section 23 31 00 - HVAC Ducts and Casings.

C. Section 26 27 17 - Equipment Wiring Systems.

1.03 REFERENCES

A. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

B. NFPA 70 - National Electrical Code.

C. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

D. UL 33 - Heat Responsive Links for Fire-Protection Service.

E. UL 555 - Fire Dampers and Ceiling Dampers.

F. ASTM E477 - American Society for Testing and Materials, Standard method of testing duct liner material and prefabricated silencers for acoustical and airflow performance.

G. ASTM E84 - American Society for Testing and Materials, testing of air conditioning and ventilation systems

H. UL-723 - Underwriters Laboratories, standard for safety; duct silencers

1.04 SUBMITTALS

A. Submit shop drawings, product data, and manufacturer's installation instructions under provisions of Section 013000.

B. Shop Drawings: Indicate for all ductwork and accessories.

C. Manufacturer's Installation Instructions: Indicate for all ductwork accessories.

D. Product Data for sound attenuators: Submit manufacturer’s product data.
   1. Include dynamic insertion loss data.
   2. Include pressure drop data.

3. Verify conformance of ASTM E477, ASTM E84, NFPA 255, UL-723, and applicable building codes.
4. Verify silencer dynamic insertion loss and pressure drop ratings based on tests performed at certified NVLAP-accredited laboratory in accordance with ASTM E477-99.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 017800.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products under provisions of Section 01600.

B. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.02 BACKDRAFT DAMPERS

A. Gravity Backdraft Dampers, Size 18 x 18 inches (450 x 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturers standard construction.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: 16 gage (1.5 mm) thick galvanized steel, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Ruskin: www.ruskin.com.
   2. Safe-Air/Dowco: www.safeair-dowco.com.
   3. Air Balance, Inc.: www.airbalance.com.
   4. National Controlled Air: www.ncamfg.com.
   5. Kees: www.kees.com.
   6. McGill
   7. Ductmate
   8. Substitutions: Under provisions of Section 01 60 00.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum one inch (25 mm) thick insulation with sheet metal cover.

D. Access doors with sheet metal screw fasteners are not acceptable.

E. Hinged access doors are not acceptable.

F. Access Door Sizes:

1. For rectangular ducts 12” or less in width, use removable duct section for access. Refer to section below.
2. For round ducts less than 16” diameter, use removable duct section for access. Refer to section below.
3. Rectangular Ducts 20" or greater in width: Access doors shall be 18" x 18" square.
4. Rectangular Ducts greater than 12” and less than 20" in width:
    a. Access door width and length = duct width minus 2".
    b. Minimum access door size shall be 12”x12”.
5. Round Ducts 16” or greater in diameter: Minimum access door size shall be 16”x12”. Use sandwich style access door equal to Ductmate Sandwich Access Door.

G. Installation:
1. Provide access doors as needed for service of ductwork accessories, including but not limited to:
    a. Fire dampers.
    b. Smoke dampers.
    c. Combination fire/smoke dampers.
    d. Duct mounted smoke detectors.
    e. Flow measuring stations.
2. Install access doors in bottom of ducts unless prevented by site conditions. Access doors shall be located such that service of ductwork accessories can be readily achieved through access door. Provide multiple access doors if required to achieve adequate access.

2.04 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.05 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Connector: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
2. Net Fabric Width: Approximately 6 inches (150 mm) wide.

C. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.87 lbs per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.

2.06 FIRE DAMPERS

A. Manufacturers:
1. Ruskin: www.ruskin.com
2. Safe-Air/Dowco: www.safeair-dowco.com.
3. Air Balance, Inc.: www.airbalance.com.
4. National Controlled Air: www.ncamfg.com.
5. Leader Industries: www.leaderindustries.com.
6. Pottorff: www.pottorff.com.
7. Prefco: www.prefco-hvac.com.
8. Nailor: www.nailor.com.
9. Greenheck: www.greenheck.com.
10. Cesco Products: www.cescoproducts.com.

B. Furnish and install, at locations shown on plans, fire dampers constructed and tested in accordance with UL Safety Standard 555. Fire dampers shall also have been tested to close under dynamic airflow conditions and be labeled as a dynamic fire damper (static fire dampers are not allowed). Each fire damper shall have a 1-1/2 hour fire protection rating, 165 degrees F

fusible link, and shall include a UL label in accordance with UL 555 Standard. Fire dampers shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings using angles, other materials, and practices required to provide an installation equivalent to that used by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions.

C. Provide UL listed dynamic multiple blade fire dampers in lieu of curtain style dampers when damper sizes exceed the damper manufacturer's listing for curtain style dampers.

D. The Mechanical Contractor shall be responsible for coordination with the General Contractor to insure that rated walls are constructed as required to meet the UL rating for the fire damper.

E. Dampers shall be provided with factory mounted integral sleeves. Length of sleeve shall be as required for each particular installation.

F. All fire dampers shall be installed in accordance with the installation instructions furnished by the manufacturer.

G. Fusible Links: UL 33, separate at 160 degrees F (71 degrees C).

H. 6" - 8" Pressure Class Duct:
   1. Damper sleeve shall be 14 gauge.
   2. Damper shall be rated for 4000 fpm and 8" w.g.
   3. Damper shall be Ruskin FD60 Multiple Blade Dynamic Fire Damper, or equivalent.

I. 4" Pressure Class Duct:
   1. Damper sleeve shall be 16 gauge for ducts 36"W x 24"H and smaller.
   2. Damper sleeve shall be 14 gauge for ducts larger than 36"W x 24"H.
   3. Damper shall be rated for 2000 fpm and 4 inches w.g.
   4. Damper shall be Ruskin D-IBD2, Style C or CR or CO, dynamic, or equivalent.

J. 1/2" - 2" Pressure Class Duct:
   1. Damper sleeve shall be 20 gauge.
   2. Damper shall be rated for 2000 fpm and 4 inches w.g.
   3. Damper shall be Ruskin D-IBD2, Style B or R, dynamic, or equivalent.

2.07 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated.

B. Spin in Collars for Low Pressure Runouts to Grills or Diffusers:
   1. 24 gage (.024") minimum damper.
   2. Use a continuous rod for dampers.
   3. Provide locking quadrant regulator.
   4. For insulated ductwork, provide 2" standoff.
   5. Acceptable Manufacturers:
      a. Flexmaster spin collar with Bo3 build out and locking quadrant for 10" diameter ducts and smaller.
      b. Flexmaster spin collar with Bo3 build out, continuous shaft, nylon bushings and locking quadrant for 12" diameter ducts and larger.
      c. Substitutions under the provisions of Section 01 60 00.
   6. Regulators that lock by tightening a wing nut over a threaded end bearing are not acceptable.

C. Round and oval dampers, 1/2" to 1" pressure class, including dampers at runouts to diffusers when spin in collars are not used:
   1. 24 gage (.024") minimum.
   2. Use a continuous rod for dampers.

3. Provide locking quadrant regulator. For insulated ductwork, provide 2" standoff. Acceptable regulators for shop fabricated dampers include:
    a. Duro Dyne Model K2.
    b. Cain Manufacturing.
    c. McGill.
    d. Substitutions under the provisions of Section 01 60 00.
4. Regulators that lock by tightening a wing nut over a threaded end bearing are not acceptable.
5. Acceptable manufactured dampers include:
    a. Ruskin MDRS27, with 2" shaft extension and locking quadrant handle.
    b. Pottorff Model CD-10R.
    c. McGill UVC9.
    d. Substitutions under the provisions of Section 01 60 00.

D. Round and Oval Dampers, 2" and Above Pressure Class:
1. 24 gage (.024") minimum, but not less than two gages more than the duct gage.
2. Provide continuous rod with open end bearings for 2" pressure class and closed end bearings for 3" and above pressure class.
3. Provide locking quadrant regulator. For insulated ductwork, provide 2" standoff. Acceptable regulators for shop fabricated dampers include:
    a. Duro Dyne Models KR3 and K3.
    b. Pottorff LQ-355 or SQ-325.
    c. McGill.
    d. Substitutions under the provisions of Section 01 60 00.
4. Regulators that lock by tightening a wing nut over a threaded end bearing are not acceptable.
5. Acceptable manufactured dampers include:
    a. Jer-Air Model RBD-38 with Can #D38 locking quadrant.
    b. Ruskin MDRS 25.
    c. Young Regulator Series 5020 with 403 style regulator.
    d. Pottorff Model CD-25R.
    e. McGill UVC8.
    f. Substitutions under the provisions of Section 01 60 00.

E. Single Blade Rectangular Dampers, Up to 12" High:
1. 22 gage (.024") minimum for dampers up to 18" wide. Use 18 gage minimum for dampers up to 48" wide.
2. Use a continuous rod for dampers up to 18" wide for 1/2" to 1" pressure class. Use 1/2" continuous rod for dampers up to 48" wide and for 2" pressure class and above.
3. End bushings are not required for 1/2" to 1" pressure class. Open end bushings are required for 2" pressure class. Closed end bushings are required for 3" and above pressure class.
4. Provide locking quadrant regulator. For insulated ductwork, provide 2" standoff. Acceptable regulators for shop fabricated dampers include:
    a. Duro Dyne Model K2.
    b. Cain Manufacturing.
    c. Young Regulator Model 403.
    d. Substitutions under the provisions of Section 01 60 00.
5. Regulators that lock by tightening a wing nut over a threaded end bearing are not acceptable.
6. Acceptable manufactured dampers include:
    a. Pottorff Model CD-10.
    b. Ruskin MDRS27, with 2" shaft extension and locking quadrant handle.
    c. Substitutions under the provisions of Section 01 60 00.

F. Multi-blade Rectangle Dampers for 1/2", 1" and 2" Low Pressure Supply, Return and Exhaust (1500 FPM Maximum Velocity):

1. Manufactured unit with opposed blade action with 18 gage minimum flat blades, 1/2" axles and end bearings.
2. Provide locking quadrant regulator. For insulated ductwork, provide 2" standoff.
3. Regulators that lock by tightening a wing nut over a threaded end bearing are not acceptable.
4. Acceptable manufactured dampers include:
    a. Young Regulator Series 820.
    b. Ruskin MD35.
    c. NCA Model MBD-57.
    d. McGill UVC8.
    e. Substitutions under the provisions of Sectio 01 60 00.

G. Multi-blade Rectangle Dampers for 3" and Above Pressure Supply Ductwork (3000 FPM Maximum Velocity):
1. Manufactured unit with opposed blade action with airfoil blades, 1/2" axles and closed end bearings.
2. Provide locking quadrant regulator. For insulated ductwork, provide 2" standoff.
3. Regulators that lock by tightening a wing nut over a threaded end bearing are not acceptable.
4. Acceptable manufactured dampers include:
    a. Ruskin CD-51.
    b. NCA ACD-54.
    c. McGill UVC27.
    d. Pottorff CD-46.
    e. Substitutions under the provisions of Section 01 60 00.

2.08 DUCT SOUND ATTENUATORS

A. Manufacturers
1. Industrial Acoustics Company
2. Price Industries
3. Semco
4. Ruskin
5. Kinetics Noise Control
6. Submit substitutions under the provisions of Section 013000.

B. Quality Assurance

1. Silencers to be tested NVLAP-accredited laboratory. The test set-up and procedure shall be such that all effects due to end reflection, directivity, flanking transmission, standing waves, and test chamber sound absorption are eliminated.

2. Dynamic Insertion Loss: Silencer dynamic insertion loss performance shall be the results of NVLAP-laboratory test performed in accordance with ASTM E477-99.

3. Pressure Drop: Silencer pressure drop performance shall be the results of NVLAP-laboratory test performed in accordance with ASTM E477-99.

C. Fabrication:

1. Outer Casing: 22 gauge galvanized steel outer casing.

2. Internal Liner: 22 gauge perforated galvanized steel internal liner.

3. Baffle Fill: Inorganic glass fiber acoustic material fill. Glass fiber packed under a minimum of 5% compression to eliminate voids due to settling.

4. Baffle Attachment: Attachment of the interior baffle partitions to the casing shall be by means of interlocking track assembly. Tracks shall be galvanized steel and shall be welded to the outer casing. Attachment of the interior baffle partitions to the tracks shall

be such that a minimum of 4 thicknesses of metal exist at this location. The track assembly shall stiffen the exterior casing, provide a reinforcement attachment detail for the interior baffle partitions, and shall maintain a uniform airspace width along the length of the silencer for consistent aerodynamic and acoustic performance. Interior baffle partitions shall be additionally secured to the outer casing with welded nose clips at both ends of the sound attenuator.

5. Construction: Silencer constructed using Pittsburgh Lock Seam sheet metal construction, and all seams shall be mastic-filled. Sound attenuators capable of withstanding a differential air pressure of 8" w.g.

6. Assembly: Factory shall assemble silencer and/or individual silencer modules and/or accessories prior to shipment.

D. Performance Data:

1. Based on testing a 24 inch by 24 inch (minimum) size unit.

2. All silencer ratings shall be determined in a duct-to-reverberant room test facility which provides for airflow in both directions through the test silencer in accordance with ASTM Specification E477-99. The test facility shall be NVLAP accredited for the ASTM E477-99 test standard. Data from a non-accredited laboratory will not be acceptable. The test set-up and procedure shall be such that all effects due to end reflection, directivity, flanking transmission, standing waves and test chamber sound absorption are eliminated. Acoustic ratings shall include Dynamic Insertion Loss (DIL) and Self-Noise (SN) Power Levels both for FORWARD FLOW (air and noise in same direction) and REVERSE FLOW (air and noise in opposite directions) with airflow of at least 2000 fpm entering face velocity.

3. Aerodynamic performance data is obtained from laboratory testing in accordance with ASTM E477-99 testing procedure. Data shall be presented for the same units as those tested to ascertain acoustical performance data.

4. Fire and smoke performance data derived from testing in accordance with ASTM E84, NFPA 255, and UL-723 testing methods. Incombustible filler material exhibits the following fire hazard classification values:

a. FLAMESPREAD - 20

b. SMOKE DEVELOPED - 20

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that electric power is available as required and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVAC Duct Construction Standards - Metal and Flexible. Refer to Section 23 31 00 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside when scheduled.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, smoke detectors, and elsewhere as indicated.

D. Provide duct test holes where required for testing and balancing purposes.

E. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment.

F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install maximum 2 duct widths from duct take-off.

G. Use splitter dampers only where manual volume dampers cannot be used due to space limitations.

H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

I. Provide transitions as required to adapt duct mounted sound attenuators to ductwork.

END OF SECTION

SECTION 23 34 23

HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Ceiling exhaust fans.

C. Upblast centrifugal roof exhausters for grease hood application.

1.02 RELATED SECTIONS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 33 00 - Air Duct Accessories: Backdraft dampers.

D. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections.

1.03 REFERENCES

A. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc..

B. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc. (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

C. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc..

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc..

E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc..

F. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.

G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association.

H. UL 705 - Power Ventilators; Underwriters Laboratories Inc..

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Provide installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Kitchen Range Hood Exhaust Fans: Comply with requirements of NFPA 96.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck: www.greenheck.com.

B. Penn Barry: www.pennbarry.com.

C. Aerovent: www.aerovent.com.

D. Howden Buffalo: www.howdenbuffalo.com.

E. Twin City: www.tcf.com.

F. Loren Cook Company: www.lorencook.com.

G. Acme Engineering and Manufacturing Corp.: www.acmefan.com.

H. Breidert/Soler & Palau: www.breidert.com.

I. American Coolair/ILG: www.coolair.com.

J. Carnes: www.carnes.com.

2.02 ROOF EXHAUSTERS

A. Product Requirements:
   1. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
   2. Sound Ratings: AMCA 301, tested to AMCA 300, and bearing 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.

B. Fan Unit: Direct driven as scheduled, with spun aluminum or galvanized steel with baked-on enamel housing; resilient mounted motor; 1/2 inch mesh, 0.062 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Roof Curb: Self-flashing of galvanized steel or aluminum with continuously welded seams, insulation and curb bottom, and factory installed nailer strip. Roof curbs shall be wind rated. Refer to Section 230548.

D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

E. Provide speed adjuster on all fans with electronically commutated motors.

F. Backdraft Damper (When Scheduled): Aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked gravity actuated.

2.03 CABINET AND CEILING EXHAUST FANS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing or unit mounted switch.

C. Grille: Molded white plastic or aluminum with baked white enamel finish.

2.04 UPBLAST CENTRIFUGAL ROOF EXHAUSTERS FOR GREASE HOOD APPLICATION

A. 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 762, Power Ventilator for Restaurant Exhaust Appliances.

B. Description: V-belt driven or direct driven as scheduled, spun aluminum, roof mounted, upblast centrifugal exhaust ventilator specifically constructed for grease hood applications. Provide grease trough.

C. Construction: Bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge alloy aluminum, bolted to a rigid aluminum support structure.
   1. The aluminum base shall have a one piece inlet spinning and continuously welded curb cap corners for maximum leak protection. An external wiring compartment with integral conduit chase shall be provided into the motor compartment to facilitate wiring connections.
   2. The motor, bearings and drive shall be mounted on a minimum 14 gauge steel assembly. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. The top cap shall be removable for access into the motor compartment. A one inch thick, three pound density foil backed heat shield shall protect the motor and drive components from excessive heat. The unit shall bear an engraved nameplate.
   3. The fan wheel shall be centrifugal, backward inclined, constructed of 100% aluminum. Wheel shall be balanced in accordance with AMCA standard 204-96.

D. Roof Curb: Provide roof curb or common curb for exhaust and make up fans as scheduled.
   1. Provide vented extension constructed of galvanized steel. Extension shall be of sufficient height to raise fan discharge 40 inches above roof.
   2. Provide hinged base to permit access to the fan inlet and interior ductwork for cleaning and inspection.

E. Electrical Characteristics and Components:
   1. Motor: Refer to Section 23 05 13 - Common Motor Requirements for HVAC Equipment.
   2. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.
   3. Disconnect Switch: Factory wired, non-fusible, in housing.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof with stainless steel lag screws to roof curb or structure.

C. Extend ducts to roof exhausters into roof curb or structure. Counterflash duct to roof opening.

D. Install flexible connections specified in Section 23 33 00 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide sheaves required for final air balance.

F. Install backdraft dampers on inlet to roof exhausters.

G. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

H. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

END OF SECTION

SECTION 23 37 00

AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Registers/grilles.

1.02 RELATED SECTIONS

A. Section 09 90 00 - Painting and Coating: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCES

A. ADC 1062: GRD - Test Code for Grilles, Registers & Diffusers; Air Diffusion Council.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc..

C. ASHRAE Standard 70 - Method of Testing for Rating the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc..

D. SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible; Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Standard 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nailor Industries, Inc.: www.nailor.com.

B. Metalaire: www.metalaire.com.

C. Titus: www.titus-hvac.com.

D. Tuttle & Bailey: www.tuttleandbailey.com.

E. Price Industries: www.price-hvac.com.

F. Carnes Company: www.carnes.com.

G. Krueger: www.krueger-hvac.com.

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Square, adjustable pattern, stamped, multi-core diffuser to discharge air as indicated on plans with sectorizing baffles where indicated.

B. Frame: In lay-in ceilings, provide inverted T-Bar type. In gypsum board ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel or aluminum with baked enamel to match color of ceiling.

D. Accessories: Provide square to round adapter as required.

2.03 STAMPED SQUARE CEILING DIFFUSERS

A. Type: Square, fixed pattern, diffuser with die formed concentric cones with uniform face size and appearance when different neck sizes are used. The inner cones shall be removable for cleaning. Diffuser is to be flush mount unless otherwise noted on plans.

B. Frame: In lay-in ceilings, provide lay-in style T bar frame. In gypsum board ceilings, provide surface mount frame suitable for hard ceilings.

C. Fabrication: Steel or aluminum with baked enamel to match color of ceiling.

2.04 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with with 3/16" diameter holes on ¼" staggered centers and fully adjustable pattern controller. Removable face.

B. Frame: In lay-in ceilings, provide inverted T-Bar type. In gypsum board ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel or aluminum with baked enamel to match color of ceiling.

2.05 PERFORATED CEILING DIFFUSERS FOR RETURN OR EXHAUST

A. Type: Perforated face with 3/16" diameter holes on ¼" staggered centers, providing 51% free area. Back pan shall be heavy duty corrosion resistant steel or aluminum, as scheduled. The face shall be removable for cleaning. Diffuser is to be flush mount unless otherwise noted on plans.

B. Frame: In lay-in ceilings, provide lay-in style T bar frame. In gypsum board ceilings, provide surface mount frame suitable for hard ceilings.

C. Fabrication: Steel or aluminum with baked enamel to match color of ceiling.

2.06 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille.

B. Fabrication: Aluminum extrusions with factory finish to match color of ceiling.

2.07 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees.

B. Frame: 1-1/4 inch margin with concealed mounting.

C. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory baked enamel finish to match color of ceiling.

2.08 ROOF HOODS

A. Fabricate air inlet or exhaust hoods in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

B. Fabricate of galvanized steel, minimum 16 gage base and 20 gage hood, or aluminum, minimum 16 gage base and 18 gage hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

C. Mount unit on minimum 14 inch high curb base with insulation between duct and curb. Provide sloped curb for installation on sloped roof.

D. Make hood outlet area minimum of twice throat area.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly. If space limitations do not allow a balancing damper to be installed at takeoff, with Engineer's approval, provide an integral, gang operated, opposed blade damper at the diffuser, grill or register. Damper shall be operable from face of grill, diffuser or register and shall have removable key operator.

E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 90 00.

END OF SECTION

SECTION 233813 – COMMERCIAL KITCHEN MAKE UP AIR SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes:
1. Direct fired make up units.

1.3 DEFINITIONS

A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.

B. Standard Hood: A hood, usually field fabricated, which complies with design, construction, and performance criteria of applicable national and local codes.

C. Type I Hood: A hood designed for grease exhaust applications.

D. Type II Hood: A hood designed for heat and steam removal and for other nongrease applications.

1.4 ACTION SUBMITTALS

A. Product Data: For make up air units, include the following:
1. Complete fan performance curves for Supply Air, with system operating conditions indicated, as tested in an AMCA Certified Chamber.
2. Sound performance data for Supply Air, as tested in an AMCA Certified chamber.
3. Motor ratings, electrical characteristics and motor and fan accessories.
4. Dimensioned drawings for each type of installation, showing isometric and plan views, to include location of attached ductwork and service clearance requirements.
5. Estimated gross weight of each installed unit.
6. Installation, Operating and Maintenance manual (IOM) for each model.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 COORDINATION

A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish one complete set(s) of grease filters/baffles.

PART 2 - PRODUCTS

2.1 DIRECT FIRED MAKE UP AIR UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Captive-Aire Systems.
2. Greenheck.
3. Trane

B. MANUFACTURED UNITS
1. Units with Integral Heating shall be fully assembled at the the factory and consist of an insulated metal cabinet, a curb assmembly, an outdoor air intake weatherhood with bird screen, a motorized intake damper, supply air blower assembly, electrical control center. All specified components and internal accessories factory installed and tested and prepared for single-point high voltage connection.

C. CABINET
1. Materials: Formed, double wall insulated metal cabinet, fabricated to permit access to internal components for maintenance.
   a. Outside casing: 18 gauge, galvanized (G90) steel meeting ASTM A653 for components that do not receive a painted finish. Pre-painted components as supplied by the factory shall have polyester urethane paint on 18 gauge G60 galvanized steel. Base rail is 12 gauge, galvazined (G90) steel.
   b. Internal Assemblies: 24 gauge galvanized (G90) steel except for motor supports which shall be minimum 14 gauge galvanized (G90) steel.
2. Cabinet Insulation: Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181.
   a. Materials: Fiberglass insulation. If insulation other than fiberglass is used, it must also meet the Fire Hazard Classification shown below.
   b. Thickness: 1 inch (25 mm)
   c. Fire Hazard Classification: Maximum flame spread of 25 and smoke developed of 50, when tested in accordance with ASTM C 411.
   d. Location and application: Floor of each unit shall be insulated with fiberglass insulation. Full interior coverage from "Heating on".
3. Access panels: Unit shall be equipped with insulated removable access panels to provide easy access to all major components. Access panels shall be fabricated of 18 gauge steel. Removable access panels shall incorporate a formed drip edge.
4. Control center / connections:
   a. Unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.
5. Direct Gas-Fired Furnace:
   a. Unit shall be factory assembled, piped, and wired. Direct gas-fired system will be 92% efficient while supplying a burner that is capable of providing 25:1 turndown. Unit will utilize a draw through design and incorporate adjustable burner baffles plates for field adjustments. Unit will have a EconomyPilot ignition system.
   b. Burner construction shall consist of a cast aluminum burner manifold and 400 series stainless steel mixing plates. No air from inside the space shall be allowed to pass across the burner at any time. Flame sensing shall be provided by a flame rod. Burner control shall have a digital coded fault indicator capable of storing the last five faults.

c. Shall be equipped for operation on Natural gas with a maximum rated inlet gas pressure of 1/2 PSI.
d. Burner control option to include the following: Discharge temperature.
e. Shall include the following safety controls:
f. Manual Reset, High Limit Switch: Main gas valve closes if high-limit temperature is exceeded.
g. Dual safety shutoff valves shall be provided that do not exceed 120 VAC control signals.

6. Motorized Inlet Air Dampers: to be of low leakage type and shall be factory installed.
7. Sensors are considered to be part of various optional operational modes or device controllers and are to be factory supplied and installed as specified by the A/E.
8. Curb Assembly: A curb assembly shall be made of galvanized steel provided by the factory for field assembly and installation as part of this division. The curb shall include a duct adapter for supply air. The installing contractor shall be responsible for coordinating with roofing contractor to ensure curb unit is properly flashed to provide protection against weather/moisture penetration. Contractor shall provide and install appropriate insulation for the curb assembly.

D. BLOWER-FC
1. Blower section construction, Supply Air: Belt drive motor and blower shall be assembled onto a minimum 14 gauge galvanized steel platform and must have neoprene vibration isolation devices, minimum of 1-1/8 inches thick.
2. Blower assemblies: Shall be statically and dynamically balanced and designed for continuous operation at maximum rated fan speed and horsepower.
3. Centrifugal blower housing: Formed and reinforced steel panels to make curved scroll housing with shaped cutoff.
4. Forward curved blower (fan) wheels: Galvanized or aluminum construction with inlet flange and shallow blades curved forward in direction of airflow. Mechanically attached to shaft with set screws.
5. Blower section source quality control: Blower performance shall be factory tested for flow rate, pressure, power, air density, rotation speed and efficiency. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".

E. MOTORS
1. Refer to Section 230512, “Common Motor Requirements for HVAC Equipment.”

F. UNIT CONTROLS
1. The unit shall be constructed so that it can function as a stand-alone heating system controlled by a factory-supplied remote panel, thermostats and sensors.
2. Sensors to be provided with the unit:
a. Heating Inlet Air Sensor
b. Dirty Filter Sensor
3. Control center shall include 24V control transformer, magnetic motor starter with overload protection, disconnect switch, distribution terminal strip and factory wiring for single point power connection.

G. FILTERS
1. Unit shall have 2" thick permanent metal filters following the outdoor air intake in a V-bank arrangement and shall be accessible from the exterior of the unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install direct fired make up air units in accordance with manufacturer’s installation instructions.

3.3 CONNECTIONS

A. Install piping with clearance to allow service and maintenance.

B. 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.

C. Provide gas and electrical connections.

3.4 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. Report results in writing.

B. Tests and Inspections:

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. Test gas components for leaks. Repair or replace leaking components.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain direct fired make up air units. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 233813

SECTION 23 40 00

HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposable panel filters.

1.02 RELATED SECTIONS

A. Section 01 50 00 - Temporary Facilities and Controls: Filters for temporary heating and ventilating.

1.03 REFERENCES

A. ARI 850 - Commercial and Industrial Air Filter Equipment; Air-Conditioning and Refrigeration Institute.

B. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc..

C. UL 900 - Standard for Air Filter Units; Underwriters Laboratories Inc..

1.04 PERFORMANCE REQUIREMENTS

A. Conform to ASHRAE 52.2.
   1. MERV rating: 8

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

PART 2 PRODUCTS

2.01 FILTER MANUFACTURERS

A. AAF International/American Air Filter: www.aafintl.com.

B. Camfil Farr Company: www.camfilfarr.com.

C. Flanders - Precisionaire: www.flanderscorp.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DISPOSABLE PANEL FILTERS

A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
   1. Nominal Size: To fit application.
   2. Thickness: 1 inch.

B. Performance Rating:

1. MERV 8
2. Face Velocity: 500 FPM.
3. Initial Resistance: 0.15 inch WG.
4. Recommended Final Resistance: 0.50 inches WG.

C. Casing: Cardboard frame.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

END OF SECTION

SECTION 23 51 00

BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
1. Listed special gas vents.
2. Listed grease ducts.

1.3 RELATED SECTIONS

1. Section 223400 Fuel-Fired Domestic Water Heaters
2. Section 233100 HVAC Ducts and Casings: Kitchen hood ductwork

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
1. Special gas vents.
2. Grease ducts.

B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and restraints, and location and size of each field connection.

1.5 INFORMATIONAL SUBMITTALS

A. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

1.7 COORDINATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LISTED SPECIAL GAS VENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Heat-Fab, Inc. Saf-T Vent.
2. Metal-Fab, Inc. Corr/Guard
3. Selkirk Inc.; Model PS

B. Description: Double-wall metal vents tested according to UL 1738 and rated for 480 deg F continuously, with positive or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1-inch airspace.

D. Inner Shell: ASTM A 959, Type AL29-4C stainless steel.

E. Outer Jacket: Aluminized steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
1. Termination: Round chimney top designed to exclude minimum 98 percent of rainfall.

2.2 LISTED GREASE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Metal Products; MASCO Corporation.
2. Heat-Fab, Inc.
3. Industrial Chimney Company.
4. Metal-Fab, Inc.

B. Description: Double-wall metal vents tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 2-inch annular space filled with high-temperature, ceramic-fiber insulation.

D. Inner Shell: ASTM A 666, Type 304 stainless steel.

E. Outer Jacket: Aluminized steel where concealed. Stainless steel where exposed.

F. Accessories: Tees, elbows, increasers, hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters and drain fittings.

2.3 GUYING AND BRACING MATERIALS

A. Cable: Three galvanized, stranded wires of the following thickness:

1. Minimum Size: 1/4 inch in diameter.
2. For ID Sizes 4 to 15 Inches: 5/16 inch.
3. For ID Sizes 18 to 24 Inches: 3/8 inch.
4. For ID Sizes 27 to 30 Inches: 7/16 inch.
5. For ID Sizes 33 to 36 Inches: 1/2 inch.
6. For ID Sizes 39 to 48 Inches: 9/16 inch.
7. For ID Sizes 51 to 60 Inches: 5/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Listed Special Gas Vent: For Category III appliances. Use double wall product for venting. Use single wall product for combustion air intake.

B. Listed Grease Ducts: Type I commercial kitchen grease duct.

C. PVC and polypropylene venting is not allowed due to the use of return air plenums.

3.3 INSTALLATION OF LISTED VENTS AND CHIMNEYS

A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

B. Seal between sections of positive-pressure vents and grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

D. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.

E. Lap joints in direction of flow.

F. Connect base section to foundation using anchor lugs of size and number recommended by manufacturer.

G. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.

H. Erect stacks plumb to finished tolerance of no more than 1 inch out of plumb from top to bottom.

I. Vent layouts shall be designed and installed in compliance with appliance manufacturer’s installation instructions.

J. Vent products shall be installed in accordance with manufacturer's instructions and UL listing.

K. All vent products used in a system shall be provided by a single manufacturer.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

B. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 235100

SECTION 23 74 13

PACKAGED OUTDOOR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged roof top units.

B. Unit controls.

C. Roof mounting curb and base.

1.02 RELATED SECTIONS

A. Section 07 60 00 - Flashing and Sheet Metal.

B. Section 23 05 13 - Common Motor Requirements for HVAC Equipment.

C. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

D. Section 23 40 00 - HVAC Air Cleaning Devices.

E. Section 23 09 13 - Instrumentation and Control Devices for HVAC.

F. Section 23 09 93 – Sequence of Operation.

G. Section 26 27 17 - Equipment Wiring.

1.03 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning and Refrigeration Institute.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning and Refrigeration Institute.

C. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

1.08 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Provide one spare set of filters.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. York: www.york.com.

B. Carrier: www.carrier.com.

C. Trane: www.trane.com.

D. AAON: www.aaon.com.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 AIR CONDITIONING UNITS

A. General: Roof mounted units having gas burner and electric refrigeration.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan and exhaust fan, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

2.03 FABRICATION

A. Cabinet: Galvanized steel with durable painted finish. Finish shall withstand a minimum of 500 hours consecutive salt spray application in accordance with ASTM B117.

B. Insulation: 1/2 inch minimum thick neoprene coated glass fiber with edges protected from erosion.

C. Supply and Exhaust Fan: Forward curved centrifugal type, resiliently mounted with direct or V-belt drive, and rubber isolated hinge mounted motor. Refer to Section 22 05 48.

D. Air Filters: 2 inch thick glass fiber disposable media in metal frames. Refer to Section 23 40 00.

E. Air Filters: Extended surface media filters. Refer to Section 23 40 00.

F. Roof Mounting Curb: 12 inches high galvanized steel, channel frame with gaskets, nailer strips. Curbs shall be wind rated. Refer to section 230548.

2.04 BURNER

A. Gas Burner: Two stage, induced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shut-off, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shut-off pilot.

B. Provide modulating burner when scheduled.

C. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.

D. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

E. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, with provisions for continuous fan operation.

F. Heat Exchanger: Stainless steel of welded construction.

2.05 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide thermostatic expansion valves and alternate row circuiting.

C. Provide cathodic epoxy type electro-disposition coating for seacoast applications.

2.06 COMPRESSOR

A. Provide hermetic or semi-hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gage ports, and filter drier.

B. When scheduled, provide variable capacity compressors using either digital scroll or variable speed technology.

C. Five minute timed off circuit to delay compressor start.

D. Outdoor thermostat to energize compressor above adjustable ambient temperature setpoint.

E. Provide step capacity control by cycling compressors and cylinder unloading (for reciprocating compressors).

2.07 CONDENSER COIL

A. Provide copper tube aluminum fin coil assembly with subcooling rows and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.

C. Provide refrigerant pressure switches to cycle condenser fans.

D. Provide cathodic epoxy type electro-disposition coating for seacoast applications.

2.08 MIXED AIR CASING

A. Dampers: Provide manual outside air dampers for fixed outside air quantity.

B. Dampers: Provide outside, return, and relief dampers with damper operator and control package to automatically vary outside air quantity. Outside air damper to fall to closed position. Relief dampers may be barometric.

C. Gaskets: Provide tight fitting dampers with edge gaskets.

D. Damper Operator: Electric actuator with spring return.

2.09 OPERATING CONTROLS - SINGLE ZONE UNITS

A. Electric solid state microcomputer based room thermostat, located as indicated.

B. Provide BACnet interface. Refer to sections 230923 and 230993 for controls interface between RTUs and BAS, and for required sequences.

C. Unit controls shall incorporate:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from set point.
   3. Short cycle protection.

D. For units equipped with hot gas reheat, provide dehumidification controls to maintain less than 60% relative humidity in the space. Use mechanical refrigeration to dehumidify and hot gas reheat to satisfy the space temperature set point.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings or illustrated by the manufacturer.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 90A.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 STARTING EQUIPMENT AND SYSTEMS

A. Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.

END OF SECTION

SECTION 23 81 01

TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric wall heaters.

1.02 RELATED SECTIONS

A. Section 23 09 00 - Instrumentation and Controls for HVAC.

B. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections. Electrical supply to units.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Submit schedules of equipment including coil and fan performance.
   3. Indicate mechanical and electrical service locations and requirements.

C. Manufacturer's Instructions: Provide installation instructions and recommendations.

D. Operation and Maintenance Data: Provide manufacturer's operating instructions, maintenance manuals and repair data, and parts listings.

E. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and protect products under provisions of Section 01 60 00.

B. Protect units from physical damage by storing in protected areas and leaving factory covers in place.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard warranty.

PART 2 PRODUCTS

2.01 ELECTRIC WALL HEATERS

A. Manufacturers:
   1. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com.
   2. Marley Engineered Products: www.marleymeh.com.
   3. Qmark: www.qmarkmep.com.
   4. Marley Industrial Products: www.marleymep.com.
   5. Berko: www.berkomep.com.
   6. Modine: www.modine.com.

7. Reznor: www.rezspec.com.
8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Assembly: UL listed and labelled assembly with terminal box and cover, and controls.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material or exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.

D. Cabinet: 0.0478 inch steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. For units controlled by a building automation system, provide factory mounting of controls. Coordinate installation with controls provider. Refer to Section 23 09 00.

E. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Section 26 27 17.

3.02 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION

SECTION 23 81 26

SPLIT-SYSTEM AIR CONDITIONERS AND HEAT PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Split-System Heat Pumps.

1.02 RELATED SECTIONS

A. Section 26 27 17 - Equipment Wiring: Electrical characteristics and wiring connections..

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project.

C. Submit installation, operation and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.05 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace split-system air-conditioning units that fail in materials and workmanship within one year from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Trane Co.

B. Carrier Air Conditioning

C. Lennox Industries, Inc.

D. Substitutions: Submit under the provisions of section 016000.

2.02 EVAPORATOR-FAN UNIT

A. Concealed Unit Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.

1. Insulation: Faced, glass-fiber duct liner.
2. Drain Pans: Galvanized steel, with connection for drain; insulated and complying with ASHRAE 62.1-2004.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2004.

B. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with thermal-expansion valve.

C. Evaporator Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.

D. Fan Motor: Multispeed.

E. Filters: 1 inch thick, in fiberboard frames with ASHRAE 52.2 MERV rating of 6 or higher.

2.03 AIR-COOLED, COMPRESSOR-CONDENSER UNIT

A. Casing steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

B. Compressor: Hermetically sealed scroll type with crankcase heater and mounted on vibration isolation. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor..

C. Refrigerant: R-410A.

D. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with ARI 210/240, and with liquid subcooler.

E. Provide corrosion resistant coating on coil for seacoast application.

F. Heat Pump Components: Reversing valve and low-temperature air cut-off thermostat.

G. Fan: Aluminum-propeller type, directly connected to motor.

H. Motor: Permanently lubricated, with integral thermal-overload protection.

I. Low Ambient Kit: Permits operation down to 45 deg F.

J. Mounting Base: Polyethylene.

2.04 ACCESSORIES

A. Thermostat: BACnet compatible with push button operation and digital display, battery backup, low voltage with subbase.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install condensing unit on wind rated equipment rails. Refer to section 230548.

END OF SECTION

SECTION 23 81 26.01

DUCTLESS SPLIT SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cooling only, wall mounted ductless split systems and controls.

1.02 RELATED SECTIONS

A. Section 26 27 17 – Equipment Wiring.

1.03 REFERENCES

A. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association.

B. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems; National Fire Protection Association.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for manufactured products and assemblies. Indicate water, drain, thermostatic valves, and electrical rough-in connections with electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

D. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

1.07 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mitsubishi, www.mehvac.com

B. Panasonic, https://aircon.panasonic.com

C. Daiken, www.daikin.com

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 AIR CONDITIONING UNITS

A. Description: The air conditioning system shall be a split system series. The system shall consist of a slim silhouette, compact, high wall mounted indoor fan coil section with wireless remote controller or wired thermostat and a slim silhouette horizontal discharge outdoor condensing unit with constant speed compressor, pre-charged with R410A refrigerant.

B. The indoor unit shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.

C. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart after power interruption function, an emergency operation function and a test run switch.

D. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

2.03 CABINET

A. The casing shall have a smooth front, top return, in a white finish. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the responsibility of the installer.

2.04 EVAPORATOR COIL

A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing. Tubing shall have inner groves for high efficiency heat exchange. The coil shall be pressure tested at the factory. A sloped condensate pan and drain with extension hose shall be provided under the coil. Drain connections shall be provided at each end of the drain pan. A condensate mini-pump shall be provided to provide a means of condensate disposal when noted on drawings.

2.05 INDOOR UNIT FAN

A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.

B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.

C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right). Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.

E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium and Low.

2.06 AIR FILTERS

A. Easily removed one-inch thick permanent cleanable panel filters.

2.07 CONTROLS

A. Factory wired controls shall include contactor, high and low pressure cutouts, internal winding thermostat for compressor, control circuit transformer, non-cycling reset relay.

B. Provide wall mounted, hard wired, room thermostat to control cooling with 'cool-off' selector switch and 'auto-on' fan control switch.

2.08 OUTDOOR UNIT CABINET

A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection. Cabinet mounting

and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

2.09 OUTDOOR UNIT FAN

A. The unit shall be furnished with a direct drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.

B. The fan motor shall have inherent protection, be equipped with permanently lubricated bearings. The fan motor shall be mounted and isolated for quiet operation.

C. The fan shall be provided with a raised guard to prevent contact with moving parts.

D. The outdoor unit shall have horizontal discharge airflow.

2.10 OUTDOOR UNIT COIL

A. The condenser coil shall be of nonferrous construction with pre-coated aluminum strake fins on copper tubing.

B. Provide corrosion resistant coating for seacoast applications.

C. The coil shall be protected with an integral metal guard.

D. Refrigerant flow from the condenser shall be controlled by means of a metering orifice.

2.11 COMPRESSOR

A. Compressor shall be mounted using rubber isolating bushings to avoid the transmission of vibration.

B. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Pipe condensate from drain pan to condensate drainage system.

END OF SECTION

SECTION 26 01 00 - BASIC ELECTRICAL REQUIREMENTS

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. This section expands and supplements requirements specified in Division 01.

B. Related Sections include the following:

1. Division 01 in its entirety.

1.2 SUMMARY

A. This Section includes the following:

1. Abbreviations.
2. Alternates.
3. Change Orders.
4. Closeout Documentation.
5. Codes, Permits & Inspections, and Labeling.
6. Color Selections.
7. Contractor Qualifications.
8. Coordination Drawings.
9. Definitions.
10. Deliveries.
11. Discrepancies.
12. Electronic Media.
13. Job Site Safety
14. Job Site Security
15. Keys.
16. Operating and Maintenance Manuals.
17. Pre-Bid Meeting.
18. Record Documents and As-Built Drawings.
19. Requests For Information.
20. Shop Drawings.
21. Substitutions.
22. Training.
23. Warranties.

1.3 ABBREVIATIONS

A. The following is a list of abbreviations that may be found in either the specifications or drawings, including subscripts to equipment connections or junction boxes:

1. A: Ampere, Ammeter
2. AC: Alternating Current
3. ACC: Air Cooled Chiller
4. ACCU: Air Cooled Condensing Unit
5. ADA: Americans with Disabilities Act
6. ADO: Automatic Door Operator
7. AF: Ampere Frame
8. AFC: Above Finished Ceiling
9. AFF: Above Finished Floor
10. AFG: Above Finished Grade
11. AHJ: Authorities Having Jurisdiction
12. AHU: Air Handling Unit
13. AIC: Amperes Interrupting Capacity
14. AL: Aluminum
15. ALT: Alternate
16. ANSI: American National Standards Institute
17. ARCH: Architect or Architectural
18. ASI: Architect's Supplemental Instruction
19. ASSCP: Auditorium Sound System Control Panel or Rack
20. AT: Ampere Trip
21. ATC: Acoustical Tile Ceiling
22. ATS: Acceptance Testing Specifications or Automatic Transfer Switch
23. AWG: American Wire Gauge
24. BFC: Below Finished Ceiling
25. BFF: Below Finished Floor
26. BFG: Below Finished Grade
27. BL: Bed Locator
28. C: Conduit
29. CATV: Cable Television
30. CCD: Construction Change Directive
31. CCTV: Closed Circuit Television
32. CCTVCP: Closed Circuit Television Control Panel or Rack
33. CD: CanDela
34. CLG: (above or flush with) Ceiling (as necessary)
35. CM: Coffee Machine or Coffee Maker or Construction Manager
36. CO: Certificate of Occupancy or Change Order
37. CON: Contactor
38. CP: Control Panel or Courtesy Phone
39. CSBA: Color Selected By Architect
40. CU: Copper
41. D: Data
42. DC: Direct Current or Door Contact
43. DDC: Direct Digital Controls
44. DFS: (North Carolina) Division of Facility Services
45. DHEC: (South Carolina) Department of Health and Environmental Control
46. DISC: Disconnect (aka Safety Switch)

47. DIST: Distribution
48. DOI: (North Carolina) Department Of Insurance
49. DOL: Department Of Labor
50. DP: Distribution Panel
51. DW: DishWasher
52. EA: Each
53. EC: Electrical Contractor
54. EE: Electrical Engineer
55. EF: Exhaust Fan
56. ES: Electric door Strike
57. ELEV: Elevator (controller)
58. ELEVCL: Elevator Cab Lights
59. EM/EMER: Emergency
60. EMT: Electrical Metallic Tubing
61. EPDM: Ethylene-Propylene-Dieneter polymer rubber Membrane.
62. EWC: Electric Water Cooler
63. EWH: Electrical Wall Heater
64. EP: Explosion Proof
65. EX: Existing (to remain)
66. F: Fixed or Fuse or Fiber
67. FA/FA: Fire Alarm
68. FAAP: Fire Alarm Annunciator Panel
69. FACP: Fire Alarm Control Panel
70. FB: Floor Box or Furnished By
71. FBO: Furnished By Others
72. FH: Fume Hood
73. FLA: Full Load Amps
74. FP: Fire Pump
75. FPC: Fire Protection Contractor
76. FPE: Fire Protection Engineer
77. FSS: Fused Safety Switch
78. FX: Flexible (conduit)
79. G,GND: Ground
80. GC: General Contractor
81. GD: Garbage Disposal
82. GF/GFI: Ground Fault Circuit Interrupter (GFCI)
83. GRAP: Generator Remote Annunciator Panel
84. GRC: Galvanized Rigid Conduit
85. GSSCP: Gymnasium Sound System Control Panel
86. GYP: Gypsum board
87. HH: Hand Hole
88. HP: Horsepower
89. HW: Headwall
90. HZ: Hertz
91. IB: Installed By
92. IBO: Installed By Others
93. ID: Inner Duct or Internal Diameter
94. IDF: Intermediate Distribution Frame
95. IG: Isolated Ground
96. IW: In Wall
97. II,III,IV,V: Lighting reflector distribution types as shown next to fixture symbol

98. IM: Ice Machine or Ice Maker
99. JB: Junction Box
100. JBOX: Junction Box
101. JP: Jockey Pump
102. K: One thousand or Keyed
103. KAIC: Amperes Interrupting Capacity (in Thousands)
104. KVA: Kilovolt-Amperes
105. KW: Kilowatts
106. LC: Lighting Contactor or Load Center
107. LCD: Liquid Crystal Display
108. LED: Light Emitting Diodes
109. LTG: Lighting
110. LPI: Lightning Protection Institute
111. LV: Low Voltage
112. MC: Mechanical Contractor
113. MCB: Main Circuit Breaker
114. MCC: Motor Control Center
115. MD: Motorized Door or Motion Detector
116. MDF: Main Distribution Frame
117. ME: Mechanical Engineer
118. MGA: Medical Gas Outlet
119. MH: ManHole
120. MIC: MICrowave or MICrophone
121. MLO: Main Lugs Only
122. MPS: Motorized Projection Screen
123. N/A: Not Applicable
124. NC: North Carolina or Nurse Call
125. NCCL: Nurse Call Central Logic
126. NCCP: Nurse Call Control Panel
127. NCTC: Nurse Call Terminal Cabinet
128. NEC: National Electrical Code
129. NECA: National Electrical Contractors Association
130. NEMA: National Electrical Manufacturers Association
131. NF: Non Fused
132. NFPA: National Fire Protection Association
133. NFSS: Non Fused Safety Switch
134. NIC: Not In Contract
135. NL: Night Light
136. NTS: Not To Scale
137. O&M: Operation and Maintenance (manuals)
138. OAH: Over All Height
139. OD: Outside Diameter
140. OH: OverHead
141. OHP: OverHead Projector
142. OS: Occupancy Sensor
143. OSHA: Occupational Safety and Health Administration
144. P: Pole, Phase or Pan
145. PAN/PNL: Panelboard
146. PC: Plumbing Contractor
147. PE: Professional Engineer or Plumbing Engineer
148. PIT: (Elevator) Pit

149. PIV: Post Indicator Valve
150. POS: Point Of Service
151. PR: Pair or Proposal Request
152. PROVIDE: Furnish, Install & Connect
153. PS: Plasma Screen
154. PT: Poke Through Assembly or Pan-Tilt
155. PTZ: Pan-Tilt-Zoom
156. PVC: Polyvinyl Chloride (Conduit)
157. REF: Refrigerator
158. RFI: Request For Information
159. RFP: Request For Proposal
160. RI: Rough-In
161. RIO: Rough-In-Only
162. RLA: Running Load Amperes
163. RTU: Roof Top Unit
164. SC: South Carolina
165. SCE&G: South Carolina Electric & Gas
166. SCO: (North Carolina) State Construction Office
167. SCP: Security Control Panel
168. SEC: Security (Junction Box or Door Connection)
169. SN: Solid Neutral
170. SPD: Surge Protection Device (aka TVSS)
171. SSCP: Sound System Control Panel
172. ST: Shunt Trip
173. SW: Switch
174. SWBD: Switchboard
175. TBB: Telephone Back Board
176. T: Transformer
177. TC: Temperature Controls or Trophy Case
178. TCC: Temperature Controls Contractor
179. TOS: Top of (Elevator) Shaft
180. TYP: Typical
181. TV: Television
182. TVSS: Transient Voltage Surge Suppression
183. UCREF: Undercounter Refrigerator
184. UG: Underground
185. UH: Unit Heater
186. UL: Underwriter’s Laboratories
187. UNO: Unless Noted Otherwise
188. UON: Unless Otherwise Noted
189. UPS: Uninterruptible Power Supply
190. V: Volt or Voice
191. W/: With
192. WG: Wire Guard
193. WP: WeatherProof
194. WT: Wireless Transmitter
195. XFMR: Transformer

1.4 ALTERNATES

A. Refer to Section 012300 “Alternates” for a complete listing and description of each alternate pertaining to work of this Contractor.

1.5 CHANGE ORDERS

A. Contractor shall not proceed with work that they consider above and beyond the Contract Documents without written authorization from the Architect and Owner. Change orders will be reviewed by the Engineer, when requested. The format for each change shall consist of the breakout of all labor, material, and equipment rental per unit and extended along with quotations from the respective suppliers for all quoted items. The bottom summary including taxes, labor rates, profit, overhead, etc. shall comply with the Division 01 specifications and local laws. Without this detailed breakdown, the change order cannot be properly evaluate by the Engineer. Any change order that the Contractor proceeds to complete, without a formally approved written change order from the Architect/Engineer, are taking a risk at their own expense.

1.6 CLOSEOUT DOCUMENTATION

A. Submit in triplicate all of the information listed below at a minimum along with all the requirements stated elsewhere in Division 01 and Division 26:

1. Operations and Maintenance (O&M) manuals as outlined below in this specification.
2. Certification letter that all electrical equipment has been tested and is operational according to the plans and specifications.
3. Certification letter that all punch list items have been corrected.
4. Certification letter that all clean-up relating to electrical work has been performed.
5. Certification letter that no asbestos or any materials containing asbestos have been used in the electrical portion of the work.
6. Contractor’s notarized affidavit of payment of debts and claims.
7. Contractor’s notarized affidavit of release of liens.

1.7 CODES, PERMITS & INSPECTIONS, AND LABELING

A. E.C. shall be responsible for contacting the local Building Department for scheduling all required tests and inspections.

B. All work shall be performed in accordance with the NEC and applicable federal, state, county, and city codes and requirements by the Local Authority Having Jurisdiction.

C. Both the Contractor and installing electrician are reminded that since the NEC is by statutory inclusion a part of the laws of the state, they bear a prime responsibility to comply with it even when the plans or specifications denote an apparent violation. This should be observed carefully and continuously, particularly during estimating

for proposal, and any discrepancies should be brought to the attention of the engineer for resolution.

D. Contractor shall include in his/her bid all costs for building permits, inspections, and prepays including utility fees unless otherwise noted herein or in Division 01.

E. Contractor shall coordinate and schedule all required State, County, City, and Engineer inspections in a timely manner so as to not “cover up” work to be inspected and to not “hold up” work to be performed by other trades.

F. All electrical equipment, materials, devices, and appliances shall be listed and labeled by a NC approved third party testing agency.

G. Anticipated inspections made by the design engineer:

1. Underground – Contractor to notify Engineer 48 hours prior to backfilling typical trenches and pouring of concrete floors for potential inspections. In the event that the Engineer cannot make it to the job site, the Contractor shall take photographs of typical underground rough-in sections, transformer pad foundation, light pole bases, etc. prior to concealing the work for the Engineer’s review.
2. Final – Contractor to notify engineer one week prior to need for potential final inspections. At this time, the following list below shall be ready for the engineer to review. If project is not complete at this time, engineer reserves the right to be compensated for additional site visits to complete the final inspection if necessary.

    a. Electrical Contractor’s own punchlist of outstanding items.
    b. Panelboard/LCC covers removed or have pictures taken for Engineer’s review.
    c. Transformer enclosures removed or have pictures taken for Engineer’s review.
    d. All circuits energized for testing.
    e. All receptacles, switches, lights, equipment, and low voltage systems devices shall be installed, operational, and tested.
    f. Service and transformer grounding connections exposed or have pictures taken for Engineer’s review.

H. After site observations are made, the Engineer will provide field reports and generate deficiency logs to the Contractor through the Architect. These items are to be addressed by the Contractor to the Architect within (14) days of receipt, unless otherwise agreed upon in writing. When the items are corrected, the items shall be initialed and dated by the electrical “foreman” and not by the electrical “project manager.”

1.8 COLOR SELECTIONS

A. All electrical equipment involving a color selection shall be brought to the attention of the Architect, via a shop drawing submittal, for their direction. Contractor shall provide the Architect with a list full range of colors that can be selected from.

Contractor shall provide color chips, samples, color brochures, etc. for the Architect's use.

B. All electrical equipment involving color selection shall be submitted at one time, along with the other finishes for other disciplines needing a color selection so that the Architect has all the information together to make a complete decision.

1.9 CONTRACTOR QUALIFICATIONS

A. Contractor shall have been in business for at least five years and have completed at least three projects of similar size and scope in the prior three years.

B. Contractor shall have proper business and employee licenses in order to perform work in the state.

C. Refer to individual specification sections for additional qualifications relevant to each specification section.

D. Contractor to provide sufficient qualified journeyman electricians who are thoroughly experienced with the materials and methods specified and familiar with the design requirement.

E. At least one qualified journeyman, designated as the superintendent, shall be present at all times during the execution of the work.

F. In acceptance or rejection in any portion of the electrical work, no allowance will be made for lack of skill on the part of the workmen.

G. Contractor shall be an approved and trained installer for the Sports Lighting System that are proposing.

1.10 COORDINATION DRAWINGS

A. A meeting shall be arranged by the General Contractor (G.C.) and take place prior to the G.C. starting the coordination drawings. This meeting shall include at a minimum the G.C., the G.C.'s major subcontractors, Architect, Owner's representative, and Engineers such that we can confirm the requirements of the coordination drawings prior to them being submitted.

B. E.C. shall coordinate with the G.C. and other trades so that the following lists of items can be indicated on a common set of plans. Site plans and sections are to be drawn to scale in all congested areas. Also, all equipment connections are to be reviewed between disciplines for equipment locations, disconnect requirements, motor controller requirements, MOCP requirements, control power/panel locations, etc. These shall be submitted collectively from all disciplines into one overall document for review by the Engineer on an as needed basis or where specifically directed within the Contract Documents. **These coordination drawings shall be submitted for review prior to any other individual product data or fabrication drawings.** Show the following at a minimum:

1. Underground utilities.
2. Light pole locations.
3. Sidewalks.
4. Conduit routing.

C. It is important to note that sports lighting assemblies and electrical gear cannot be fabricated, until the coordination drawings have been compiled, submitted, and approved. Any material procurement or installation work commenced prior to approval is taken at the risk of the Contractor and may have to be modified/moved at their cost.

1.11 DEFINITIONS

A. Where the word “Architect” is used herein, it shall be construed to mean the Engineer in charge of the project.

B. Where the word “provide” is used relating to a system or piece of equipment, it shall be understood to mean the furnishing and installing of the system or equipment.

C. Where the word “furnish” is used relating to a system or piece of equipment, it shall be understood to mean supply to the project only, for installation under other Divisions as part of this contract.

D. Where the word “install” is used relating to a system or piece of equipment, it shall be understood to mean to place and put in service equipment furnished under other Divisions as part of this contract.

E. Where the phrase “as directed” is used, it shall be understood to mean direction given to the Contractor by the Architect, Engineer, or Owner.

F. Where the phrase “as indicated” is used, it shall be understood to mean as shown on drawings by notes, graphics or schedules, or written into other portions of contract documents. Terms such as “shown”, “noted”, “scheduled” and “specified” have the same meaning as “indicated”, and are used to assist the reader in locating particular information.

G. Where the word “Contractor” is used, it shall be understood to mean the contractor responsible for all Division 26 specifications and electrical drawings, unless otherwise noted. For projects where one prime contract is awarded, the Prime Contractor shall be responsible for all Division 26 work included in these specifications and electrical drawings.

H. Where the term “E.C.” is used, it shall be taken as a guide for the scope normally performed by the Electrical SubContractor, whereas when the term “G.C.” is used, it shall be taken as a guide for the scope normally performed by the General Contractor. For projects where multiple prime contracts are awarded, the Electrical Contractor shall be responsible for all Division 26 work included in these specifications and electrical drawings.

I. Where the term “switchgear” is used, it shall in general refer to all types of switchgear equipment such as transformers, panelboards, switchboards, load centers, disconnects, motor starters, motor control centers, transfer switches, paralleling gear, medium voltage switching equipment, unit substations, variable frequency drives, etc.

1.12 DELIVERIES

A. All deliveries for equipment ordered by the Contractor shall be accommodated by the Contractor. Contractor shall coordinate deliveries and storage space for equipment during hours that the Contractor is on site. The Owner will not be responsible for receiving/unloading equipment whether during working hours or after hours, unless otherwise closely coordinated up front with the Owner. Contractor shall also provide their own means of unloading equipment.

1.13 DISCREPANCIES

A. Should it appear that there is a discrepancy between or within the Division 26 drawings, and/or Division 26 specifications, and/or the local Authority Having Jurisdiction’s interpretations, and/or local Utility Companies regulations concerning the nature, quality or extent of materials or work to be furnished and/or installed, and such discrepancy is not brought to the Architect/Engineer’s attention during Bidding for a formal written Addendum clarification, this Contractor shall base his/her bid on performing the work in the manner having the higher cost or more stringent option. The Architect/Engineer shall then have the option during construction of selecting either of the manners shown and/or specified at no additional cost to the Owner. In the event the lower cost manner is selected, a credit shall be due the Owner in the amount of the difference between the lower cost and higher cost manner. All discrepancies shall be called to the attention of the Architect before proceeding with work affected thereby.

B. This specification section is not meant to contradict other specification sections that describe similar scopes of work. The intent of this section is to clarify any basic issues that may have been omitted in other Divisions or are not entirely clear as to how they affect the Contractor(s) of this Division.

C. Should it appear that there is a duplication on the Drawings or in the Specifications, wherein the same work or items are shown or specified as being provided under different contracts, subcontracts or supply orders, and such duplication is not brought to the Architect/Engineer’s attention during Bidding for a formal written Addendum clarification, it shall be assumed that the Prime Contractors have included duplicate quotations in their proposal to the Owner. The Architect/Engineer shall then have the option during construction of selecting the contract or subcontract under which the work or items are to be provided and a credit shall be due the Owner for the duplicate work or items.

D. The design drawings, as submitted, are diagrammatic and are not intended to show exact location of equipment, light poles, utility poles, electrical devices above and below counters, floor boxes, poke-throughs, power poles, wall mounted lights,

television outlets and receptacles, etc. unless dimensions are given. Drawings are not to be scaled. Verify all exact locations with Architect prior to rough-in. Verify mounting heights of all surface raceways in finished areas and heights of wiring devices above or below casework with the Architect prior to rough-in.

1. Equipment shall be installed along the general arrangement indicated on the drawings, and in accordance with the manufacturer's instructions.

    a. Provide at least the minimum manufacturer's recommended and code required clearance around the equipment for normal maintenance.
    b. Locate and arrange equipment in relationship to other system components to assure that the equipment will be operating under the best possible conditions to meet the scheduled performance requirements.

2. Raceways are to be installed along the general plans shown on the drawings keeping in mind the constraints of the available space and the need to coordinate with the work of other trades. Additional bends, pull and splice boxes shall be provided as necessary to meet space constraints and to facilitate the work of other trades.

E. Electrical equipment, specified hereinafter as shown on the drawings shall be furnished and installed by this Contractor, unless specifically indicated to the contrary.

F. Occasionally, certain references may be indicated on the Drawings to items which are suggested to be furnished and/or installed by various subcontractors. This is done to assist the applicable Prime Contractor in organizing his subcontractor's bids. However, no attempt has been made, nor is it implied, that this specification or plans are attempting to specifically divide all responsibilities for subcontractors. It is the Prime Contractor's responsibility that all items covered on electrical plans and Division 26 specifications are included in his bid and are coordinated with his subcontractors. No consideration will be given for Prime Contractor's failure to include all applicable electrical work in his bid.

G. Where more than one manufacturer is named for major items of equipment, the manufacturer noted on the Drawings has been used as a basis for design. If another manufacturer is used, other than the one named on the Drawings, it shall be the responsibility of this contractor to ensure that the equipment will fit the space with all legal clearances, or bear the expense to change the space and structure to accommodate equipment used.

1.14 ELECTRONIC MEDIA

A. Where the Contractor is required to produce full size drawings for shop drawings, as-builts, or to outline the work involved for his/her use (i.e. fire alarm, lightning protection, voice/data, point-by-point lighting calculations, etc.), the electronic drawings will be available to the contractor. The contractor will have to fill out and sign a waiver/release form from the engineer. The engineer will provide electronic CAD drawings for the fee of $50/sheet or PDF drawings for the fee of $20/sheet. Payment must be received before the release of electronic drawings. This

requirement is not intended to restrict the contractor from preparing shop/coordination drawings in a timely fashion. If the contractor deems this requirement to restrictive, then the contractor shall proceed as if the electronic drawings are not available. The file type will be coordinated with the Engineer.

1.15 JOB SITE SAFETY

A. The Contractor and not the Engineer is responsible for all job site safety relating to his or her work. The Contractor shall be familiar with all safety requirements, such as OSHA regulations, and comply accordingly. The Contractor shall coordinate providing of all personal protection equipment with their employees.

1.16 JOB SITE SECURITY

A. The Contractor shall be responsible for all security of their employees, materials, tools, and equipment. Contractor shall lock up and store materials, tools, and equipment accordingly.

1.17 KEYS

A. During construction, this Contractor shall keep the keys for any and all electrical cabinets, panelboards, lockable covers, manual pull stations, keyed switches, etc. As part of the closeout procedures, this Contractor shall turn over to the Owner six identical key rings with a full set of spare keys on each. Each key shall be labeled with its corresponding designation on a hand written or machine printed label. If six keys of each type do not come with the equipment for the project, have the manufacturer produce additional keys to fill the set.

1.18 OPERATING AND MAINTENANCE MANUALS

A. As part of closeout procedures the Contractor shall turn over to the Architect/Engineer for approval a minimum of three (3) copies of operation and maintenance manuals. Refer to Division 01 for quantity of O&M manuals that may exceed the minimum three. The approved manuals shall then be turned over to the Owner, upon review of the Architect/Engineer. These O&M manuals shall consist of 3-ring binders with loose leaf information, permanent covers, clearly identified and indexed with table of contents, tabs for each section, containing the following at a minimum:

1. Complete list of personnel and contact info for any related warranty work.
2. Complete description of the automatic operation, manual operation, and safety features built into the system.
3. Step-by-step procedures for start-up, operation, and shut-down for each system and piece of equipment.
4. Complete list of diagnostic and troubleshooting procedures for systems and major equipment.

5. Recommended preventative maintenance program for each piece of mechanical equipment, and each system, including items to be inspected and serviced, frequency of inspection and servicing, the type of servicing required, and types of lubricants to be used.
6. As-built material list including make and model numbers.
7. Catalog brochures for all components with specific parts used, marked clearly.
8. Supplier's and manufacturer's conformance of specifications and drawings certificates.
9. Copy of all test reports by manufacturer and contractor.
10. Performance data, curves, ratings.
11. Dimensional drawings.
12. Wiring and block diagrams, indicating factory wiring separate from field wiring.
13. Required settings.
14. Manufacturer's descriptive literature.
15. Manufacturer's maintenance and service manuals.
16. Multiple copies of Manufacturer's **original** installation and maintenance manual that comes with the equipment itself.
17. Spare parts bill of material.
18. Owner's sign off sheets for receipt of spare parts and training.
19. Name of service agency and installer complete with an emergency service phone number for nights, weekends and holidays.
20. Final approved shop drawings.
21. Warranties and guarantees.
22. Copies of all inspection reports and checkout forms by AHJs, inspectors, utilities, manufacturers, NFPA 72 Record of Compliance Form, etc.
23. Owner's training video tapes, if applicable.
24. Any other pertinent information that the Contractor or Manufacturer feels is important for the Owner to know about the electrical equipment or system.

1.19 PRE-BID MEETING

A. All persons wishing to submit quotations for work in accordance with these plans and specifications are strongly urged to attend the pre-bid meeting for further insight into the project.

1.20 RECORD DOCUMENTS AND AS-BUILT DRAWINGS

A. The Contractor shall maintain on site at all times a dedicated space for a current set of red-lined as-built specifications and drawings to record revisions to the original set of construction documents. These revisions shall include, but are not limited to: major interior conduit routings, all exterior underground raceways, manholes, and handholes, all Architect's Supplemental Instructions, all Bulletin drawings, all Addenda descriptions and drawings, all Change Orders, all Construction Change Directives, all Contractor field revisions such as circuiting changes, etc.

B. The Engineer or Owner may at any time ask to review the as-built drawings and specifications during construction.

C. These as-built plans and specifications shall be in addition to the sets used by the installing electricians in carrying out their day to day work on the project. The projected location of every outlet, raceway, or item of equipment to be installed under this contract shall be checked against the plans and specifications of all the other trades as well as by daily conference with workmen and supervisors of all other trades to the extent that any conflicts or uncertainties about locations are resolved before work is installed, particularly sprinkler head locations, etc. ceiling construction installation shall be made in accord with reflected ceiling plans and/or instructions by the Architect's representatives on the site. Moving of items from locations shown, rerouting, or changes to accomplish any work as shown on plans or specifications in order to accomplish this coordination shall not be a cause for claim for additional compensation for the work.

D. As part of the closeout procedures, the Contractor shall take a clean set of drawings and produce one set of as-built specifications and drawings in red ink with a signed Record Drawing stamp. These drawings are to be turned over to the Owner. These documents shall be called the Record Documents.

1.21 REQUESTS FOR INFORMATION

A. When a question, clarification, or discrepancy arises after the Bid has been awarded, the Contractor shall submit in writing to the Architect an RFI to document the issue. The RFI must indicate the drawings and/or specification sections being referenced and eluded to. Upon receipt, the Engineer will then respond back to the RFI in writing as soon as possible given the circumstances of the RFI. Contractor shall take proper measures to initiate RFI in a timely fashion in order for the Engineer to properly evaluate.

1.22 SHOP DRAWINGS

A. Within 15 calendar days following Contract approval or Notice To Proceed and prior to submitting shop drawings, this Contractor shall submit to the Engineer a list of proposed manufacturers and (sub)Contractors for each specification section and each major piece of equipment for approval. Along with the above information, Contractor to submit the Pay Application Schedule Of Values and a Shop Drawing Submittal Schedule to the Engineer for their review coordination.

B. All shop drawings shall be submitted to the Architect for review within 30 days of receiving a contract, so as not to delay the project.

C. This Contractor shall review, stamp and sign with his/her approval and submit in an orderly sequence so as to cause no delay in the work or in the work of any other Contractor, all submittal information and samples required by the contract documents. Submittal information not stamped with Contractor approval will be returned for reprocessing.

D. Contractor shall **not** begin fabrication or rough-in work or release of materials until return of submittals with Engineer's approval. This is especially important for rough-in items below grade (such as light poles).

E. In approving the submittals, the Contractor guarantees that the submittals accurately and completely represent the equipment and materials to be installed.

F. Shop drawings shall be submitted for ALL material items as outlined in these specifications. Any deviations from contract requirements must be clearly indicated on shop drawings, and justification for their consideration must be included.

G. Acceptance of submittal items will not preclude rejection of those items upon later discovery that their suitability for the application or ability to meet the requirements of these specifications was misrepresented in the submittals.

H. Submittals for equipment shall include detailed dimensional drawings which completely and accurately represent the specific piece of equipment to be supplied and all required clearances. When more than one piece of similar equipment is to be supplied, provide accurate dimensional drawings for each unique size and/or configuration of the equipment.

I. In checking shop drawings, the Engineer will make every effort to detect and correct errors, omissions and inaccuracies in such drawings, but his/her failure to detect errors, omissions and inaccuracies shall not relieve the Contractor of responsibility for the proper and complete installation in accordance with the intent of the Contract Documents.

J. The shop drawings will be reviewed by the Engineer per specification section. The Contractor shall bind together multiple specification section shop drawings if they so desire, however a separate shop drawing review sheet shall be issued for each section. This will help identify the issues involved with each item, rather than accepting or rejecting the entire submittal as a whole. However, a single specification section shop drawing shall not be broken out and submitted as partial shop drawings as the entire shop drawing for that specification section must be submitted together. If the Contractor submits multiple copies of partial shop drawings, they will not be reviewed by the Engineer and will be sent back as rejected.

K. In the event of multiple shop drawing (re)submissions for the same equipment or specification section, the Engineer reserves the right to require additional fee for a third review of the same shop drawing if the Contractor continues to not adhere to the shop drawing requirements listed in the specifications and the Engineer’s prior review comments.

L. Contractor shall maintain at the site a complete set of all shop drawings, fixture and equipment cut sheets, manufacturer’s wiring diagrams, and installation data. Installing personnel shall study this data before and during installation and rough-in so as to prepare for the proper fit and function upon completion.

M. Coordinate the quantity of shop drawings to be submitted with Architect at the outset of the project, ensuring that the Engineer can retain at least one copy for his/her records.

N. The shop drawings shall indicate factory wiring separate from field wiring.

O. The shop drawings need to illustrate all required rough-in box sizes.

P. The Engineer will perform due diligence in reviewing shop drawings as quickly as they are received. However, if the majority of the shop drawings are received at the same time, the Contractor shall provide the Engineer with a priority list for their use in reviewing the shop drawings in that order to best expedite the project.

Q. Contractors options:

1. For products specified only by reference standard, Contractor shall select any product meeting that standard.
2. For products specified by naming several manufacturers or manufacturer's make and model numbers, select any one of the products or manufacturers named. Be aware that just because a manufacturer is listed does not guarantee that they comply with all of the specifications. The manufacturer still has to illustrate through shop drawings that they meet all the required criteria in the specifications prior to approval.
3. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions for any product or manufacturer not specifically named during the Bidding process for formal pre-approval.

1.23 SUBSTITUTIONS

A. Bids concerning the use of substitute products must be accompanied by complete specifications and performance characteristics covering these products, together with such available test data and experience records as may be helpful to the Engineer in evaluating the quality and/or suitability of the proposed products, including:

1. Comparison of the qualities of the proposed substitution with that specified.
2. Changes required in other elements of the work because of the substitution.
3. Effect on the construction schedule.
4. Cost data comparing the proposed substitution with the product specified.
5. Availability of maintenance service, and source of replacement materials.
6. Total cost of ownership.
7. Effect on electrical service size and circuits.

B. A request for a substitution constitutes a representation that the Contractor:

1. Has investigated the proposed product and determined that it is equal to or superior in all respects to that specified.

2. Will provide the same warranties or bonds for the substitution as for the product specified.
3. Will coordinate the installation of an accepted substitution into the work, and to make the work complete in all respects.
4. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
5. Absorb all costs incurred by the substitution when affecting other trades, including but not limited to electrical, structural and architectural, etc.
6. Absorb any cost incurred by the Architect/Engineer in review of the substituted product if the acceptance of the substituted item creates the need for system modification and/or redesign, or if the substituting contractor exhibits negligence in his substituting procedure thus submitting inferior, misapplied or mis-sized equipment. In the event of additional engineering costs, the billing structure shall be agreed upon prior to review by all involved parties.

C. Where more than one make or name is mentioned as being acceptable, it shall be understood that only the name or make referring to the manufacturer's model numbers or sizes shall be considered the "Specified Standard". It shall be further understood that other makes and names, even though mentioned, have not been checked for detail and that their size and arrangement are the Contractor's responsibility the same as a proposed substitute item.

D. The intent of this section is to make the specifications open to all available makes of material and apparatus during the bidding period. Substitutions will only be allowed to be submitted for pre-approval to the Engineer up to ten days prior to bid opening. The substitutions will be reviewed at that time by the Engineer with reasonable promptness. Substitution materials and equipment will only be incorporated into the project if the Engineer pre-approves the intent of the shop drawing(s) and lists the manufacturer’s make and model on an official written and distributed Addendum. No substitutions will be reviewed by the Engineer during construction.

1.24 TRAINING

A. Refer to individual specification sections for quantity and description of required Owner’s Training.

B. Contact and schedule with the Owner two weeks ahead of time for all training. Stress to the Owner to have any and all relevant personnel, teaching staff, and maintenance staff available for the training.

C. Personnel conducting training shall be: trained and experienced in maintenance and operation of equipment, familiar with specification requirements, skilled as a technical writer to the extent required to communicate essential data, and skilled as a draftsperson competent to prepare required drawings.

D. Distribute and review operations and maintenance manuals, shop drawings, record drawings, warranties, spare parts, keys, etc. at that time. Provide hands on demonstration of equipment operation, maintenance, troubleshooting, and features. Review spare parts inventory and contact information for future maintenance.

Prepare a written sign off sheet for all attendees to sign having witnessed the training. Include the training sign off sheet as part of the closeout documents. Record all training and provide DVD to Owner as part of the closeout procedure.

1.25 WARRANTIES

A. Refer to individual specification sections for quantity and description of required Warranties.

B. Prepare and deliver to the Owner all formal written certificates of warranty clearly stating the scope of the warranty and time period.

C. All warranties to commence at the time of Final Completion regardless of startup time or turnover to the Owner. Provide monies in the bid as required to accommodate the start of this warranty period.

D. All equipment under this Division of work shall be warranted for a minimum of one year or manufacturer's minimum warranty whichever is greater, unless otherwise noted. During this warranty period, the Contractor shall replace any and all defective equipment and parts at no additional cost to the Owner.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 26 01 00

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

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.

B. Related Sections include the following:

1. Section 26 05 33 "Raceways and Boxes for Electrical Systems” for work relating to sleeves.

1.2 SUMMARY

A. This Section includes the following:

1. Cleanup.
2. Concrete.
3. Damages.
4. Delivery, storage, and handling.
5. Electrical equipment coordination and installation.
6. Equipment wiring and equipment diagrams, details, and risers.
7. Excavation, backfill, and compaction.
8. Grading and planting.
9. Intent of drawings and specifications.
10. Lug ratings.
11. Painting and caulking.
12. Rough-in.
13. Site visits.
14. Temporary protection of electrical equipment.
15. Temporary power.
16. Temporary power usage fees.

1.3 SUBMITTALS

1.4 QUALITY ASSURANCE

A. Test Equipment Suitability and Calibration: Comply with NETA ATS, "Suitability of Test Equipment" and "Test Instrument Calibration."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONCRETE

A. Concrete Materials:

1. Portland Cement: ASTM C 150, Type I, except as otherwise indicated.
2. Aggregates: ASTM C 33, except as otherwise indicated.

a. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used.
b. For rough grouting, provide aggregate which is well graded and 100 percent passing through 3/8" sieve.

3. Water: Clean and free of substances harmful to concrete.
4. Design Mix: Design electrical work concrete as follows, for each 28-day compressive strength class.

a. 4000 psi Class: 565 lbs. of cement per cu. yd. (6.0 sacks), and 0.35 water/cement ratio.
b. 3000 psi Class: 500 lbs of cement per cu. yd. (5.25 sacks), and 0.46 water/cement ratio.
c. 2500 psi Class: 450 lbs. of cement per cu. yd. (4.75 sacks), and 0.54 water/cement ratio.
d. Mix for Patching: Where electrical work requires patching of exposed concrete work which has been cut to accommodate electrical work, provide concrete patching mix which is identical with mix of work being patched (same cement, aggregates, admixtures and proportioning).

PART 3 - EXECUTION

3.1 CLEANUP

A. This Contractor shall be responsible for daily cleanup of all their electrical product debris. This includes but is not limited to: empty cardboard boxes, scrap wire and insulation, scrap conduit, etc.

B. This Contractor shall be responsible for final cleanup and wipe down of electrical items in their scope. These items include but are not limited to: switchboard/panelboard interior tubs, floor boxes, surface switchboard/panelboard covers and tubs, surface mounted raceway, wiring devices, low voltage outlets, low voltage system cabinets and racks, light fixture lenses and louvers, etc.

3.2 CONCRETE

A. This Contractor shall furnish and install concrete foundations or bases under all electrical equipment that rests on floors, concrete encased ductbanks and exterior lighting fixture pole bases. Contractor shall follow drawings and/or manufacturer's literature and/or utility company requirements with regard to design and construction of same.

B. Formwork:

1. General: Design, construct and maintain formwork to support vertical and lateral loads including pressure of cast-in-place concrete. Construct formwork so that formed concrete will be of required size and shape and in required location. Construct with joints which will not leak cement paste. Form sides and bottoms of concrete work, except where clearly indicated to be cast directly in excavation or against other construction, or on grade or prepared subgrade. Design and construct forms for easy removal without damage to concrete and other work.

    a. Install chamfer strips at external corners of exposed concrete work.
    b. Construct forms to retain equipment anchor bolts in accurate locations during placement of reinforcing steel and concrete. Use templates furnished by equipment manufacturers to locate anchor bolts or, where not furnished, locate by accurate measure from certified setting diagrams.

C. Placing Reinforcement:

1. General: Comply with requirements and recommendations of specified standards, including "Placing Reinforcing Bars" by CRSI. Place bars where indicated and support to prevent displacement during concrete placement, using appropriate reinforcement supports, properly spaced and wire tied to reinforcing bars.

    a. Place reinforcement to obtain at least minimum recommended coverages for concrete protection. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

2. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which would reduce bond with concrete.

D. Placing Concrete:

1. Wet wooden forms which have been coated with compound, immediately before concrete, and remove excess water from forms.

2. Strength-Class Application: Comply with the following general application requirements.

   a. Plain Concrete Encased Ductbanks: Provide 2500 PSI class.
   b. Reinforced Concrete Encased Ductbanks: Provide 3000 PSI class.
   c. Underground Structural Concrete: Provide 3000 PSI class.
   d. Concrete Pole Bases: Provide 4000 PSI class.
   e. Miscellaneous Supported Work: Provide 3000 PSI class for electrical equipment pads and similar supported work.
   f. Concrete Fill: Provide 2500 PSI class for filling structural steel foundation frames and for filling similar large-volume units.
   g. Concrete Grout: Provide rough grouting class for filling voids to be grouted which are too small to be filled effectively with 2500 PSI class concrete.
   h. Patching General Concrete Work: Match concrete being patched.

3. Deposit concrete continuously or in layers of thickness which will result in no concrete being placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section. If section cannot be placed continuously, provide construction joints. Deposit concrete as nearly as practicable in its final location, so as to avoid segregation due to rehandling or flowing.
4. Place concrete in ductbanks slowly such that the force of the concrete does not force up the conduits.
5. Red dye shall be applied to the top of freshly placed concrete in all underground duct banks as a warning of electrical hazard in the event of future excavation. This is in addition to the required warning tape.
6. Use only minimal water additive to concrete mixture to allow time to smooth off exposed surfaces.
7. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures complying with recommended practices of ACI 309; eliminate voids in work.
8. Bring horizontal surfaces to correct level with straightedge and strike off. Use bull floats or darbies to smooth surface, free of humps and hollows.
9. Cold Weather Placement: Comply with ACI 306. Do not use frozen materials or materials containing ice and snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. When air temperature has fallen or is expected to fall below 40 deg F (4.4 deg C), heat water and aggregates uniformly before mixing, as required to obtain concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (26.7 deg C), at time of placement. Protect concrete work from physical damage and reduced strength resulting from frost, freezing actions, or low temperatures.
10. Finishing Horizontal Surfaces: Float and trowel horizontal (top) surfaces to level, smooth, uniform textured, dense finish, where surface is to remain exposed or receive coating, membrane or other thin-set finish. Otherwise, leave struck-off surface undisturbed; except scratch surfaces which are to receive concrete or mortar topping.
11. Finishing Concrete Pole Bases: Remove all exposed formwork. "Sonotube" forms for round bases shall be removed to below depth of adjacent paving or grade whichever is applicable. Rub out entire surface of concrete pole base to smooth, uniform texture.

12. Surface Repairs:

    a. Unexposed Surfaces: Repair significantly damaged and honeycombed areas, and remove major projections and fins where forms have been removed.
    b. Exposed Surfaces: On formed surfaces which are to be exposed, including those to be coated or covered with membrane or other thin-set applied finish, repair and patch form-tie holes and damaged and honeycombed areas, filling voids with grout and completely removing fins and other projections.

E. Concrete Curing and Protection:

1. General: Protect freshly placed concrete from drying and excessively cold and hot temperatures, and maintain in moist condition at relatively constant temperature for period of time necessary for hydration of cement, proper hardening, and achievement of strength requirements as specified.

F. Miscellaneous Concrete Work:

1. Concrete Grouting: Space approximately 1" thick between bottom of equipment and top of concrete foundation or base which remains after shimming, shall be filled completely with grouting. Grout shall be made up with sand and cement designed for the purpose which does not shrink on setting up. Exposed surface of grouting shall be finished to make a neat appearance. Grout openings and recesses as indicated, in and around mechanical work and other work which penetrates or adjoins mechanical concrete work, using rough grouting class of concrete mix. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.
2. Concrete Equipment Pads: In the absence of more specific information, either on drawings, or manufacturer's or utility’s literature, the bases shall be level, shall have a minimum height above finished floor/grade of 3-1/2" and extend beyond the base dimensions of the item of equipment (3” for interior pads and 6” for exterior pads). Where the terrain is sloped for an outdoor installation, provide additional concrete as required to ensure that each corner of the pad is a minimum of 3-1/2” above finished grade to prevent water sloping onto the pad from a low corner.
3. Concrete pads placed in existing structures shall be mounted securely to the original substrate with anchor bolts.

3.3 DAMAGES

A. The Contractor will be held responsible for any and all damages to portions of the building caused by it, its employees and subcontractors, including, but not limited to:

1. Damage to any portion of the building caused by the movement of tools, materials, or equipment.
2. Damage to any component of the construction of spaces “turned over” to the Contractor.

3. Damage to the electrical distribution system and/or other space “turned over” to the Contractor.
4. Damage to the electrical, mechanical and/or life safety, or other systems caused by inappropriate operation or connections made by the Contractor or other actions of the Contractor.
5. Other damage to the materials, tools, and/or equipment of the Owner, its consultants, General Contractor, subcontractors, Architect, and other contractors, agents, and leases.

3.4 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with the Owner for secure storage or equipment and materials or provide secured remote storage.

B. Do not store equipment where conditions fall outside manufacturer’s recommendations for environmental conditions. Secure all sensitive electronic equipment in temperature and humidity controlled areas.

C. Wherever possible, store indoors. Where necessary to store outdoors, store sufficiently above grade and enclose with watertight wrapping.

D. Handle equipment carefully to prevent physical damage to equipment and components. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering and jarring which would damage the electrical equipment contained therein. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

E. Have conduit and all items in cardboard boxes shipped and stored on wooden pallets. Have boxes labeled from the factory to easily indicate materials inside and what electrical designation they are for. Utilize factory-fabricated type containers or wrappings for equipment and components which protect them from damage.

F. Coordinate shipping of large equipment with the construction timing of the building to ensure building is “dried in” or equipment can be moved in or out of building easily. If equipment needs to be assembled and/or reassembled to get it out or into the building, then do so without voiding any manufacturer’s warranty. Field verify all existing passageways, door ways, elevator sizes and capacities, window openings, etc. prior to bid to determine how to move equipment in and out. Modify openings as required to move equipment in and out.

G. Coordinate receiving of large items with unloading equipment on site or obtain rental equipment as required. Coordinate location, size, and weight of all large equipment items located inside the building with the Structural Engineer.

3.5 ELECTRICAL EQUIPMENT COORDINATION AND INSTALLATION

A. When noted in the specifications or on the drawings that a certain manufacturer was the “basis of design,” the engineer has designed the project around the manufacturer (while allowing equals manufacturers where noted). The contractor and equal named manufacturers are responsible for coordinating equipment/programming/dimensions/weights/capacity, etc. differences for providing equipment from an equal named manufacturer as opposed to the manufacturer used as the “basis of design.”

B. When utilizing existing low voltage head-end equipment to serve new devices or equipment, Contractor/Manufacturer to verify existing equipment is capable of being reused and extended from prior to bid. Contractor/Manufacturer to provide any and all additional equipment, programming, power supplies, etc. to make new devices shown operate from the existing head-end equipment. No additional compensation will be made for equipment found out to be insufficient during construction.

C. When two or more items of the same equipment are required (i.e. switchgear, wiring devices and plates, low voltage systems, light fixtures of the same type, etc.), they shall be of the same manufacturer.

D. Comply with NECA 1.

E. Coordinate arrangement, mounting, and support of electrical equipment so connecting raceways, cables, and wireways will be clear of obstructions and of the working and access space of other equipment.

F. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

G. Coordinate electrical testing of electrical, mechanical, and architectural items, so equipment and systems that are functionally interdependent are tested to demonstrate successful interoperability.

H. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

I. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements. Install additional conduit, cable tray, busway, pullboxes, spliceboxes, etc. where required to obtain maximum headroom or to avoid conflict with other work without additional cost to the Owner.

J. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

K. Right of Way: Give to raceways and piping systems installed at a required slope. Provide addition trenching, conduit, sleeves, fittings, etc. as required to accommodate adjacent systems.

L. Before installing any work, this Contractor shall see that it does not interfere with clearance required for finish on beams, columns, pilasters, walls or other structural or architectural members, as shown on Architectural Drawings. If any work is so installed and it later develops that Architectural design cannot be followed, Contractor shall, at his own expense, make such changes in his work as the Architect may direct to permit completion of Architectural work in accordance with plans and specifications.

M. Report any interferences between work under this division and that of any other Contractors to the Architect as soon as they are discovered. The Architect will determine which equipment shall be relocated, regardless of which was first installed, and his decision shall be final.

N. Contractor shall coordinate with the Owner for the Owner to make required applications for electrical, telephone, cable television, etc. services in a timely fashion so as to not impede the flow of work.

O. Verify all dimensions by field measurements.

P. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.

Q. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.

R. Coordinate connection of electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.

S. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.

T. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components.

U. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.

3.6 EQUIPMENT WIRING AND EQUIPMENT DIAGRAMS, DETAILS, AND RISERS

A. Wiring and elementary diagrams for equipment as shown on the drawings are based on the product of the specified equipment manufacturer and are shown for convenience to aid in estimating the extent of the work involved. The equipment actually installed shall be wired and connected in accordance with the equipment manufacturer's recommendations and shall conform to details in approved wiring diagrams to be furnished by the equipment manufacturer. All equipment so connected shall be made to operate in a safe, proper and efficient manner. Note that control circuitry is not necessarily shown on the drawings but shall be installed in conduit between the points and devices indicated on the diagrams.

B. Unless otherwise shown on the drawings or specified herein, it is the intent of this Division to provide all electrical equipment and connections required to protect, properly operate, and control all equipment furnished and installed under this and other Divisions of the specifications or shown on the drawings.

3.7 EXCAVATION, BACKFILL, AND COMPACTION

A. This Contractor shall provide all excavation, backfill, and compaction required for the work covered under this Division.

B. Excavation:

1. Verify the location of all underground piping, foundations and any other underground utilities before commencing work. Perform survey work and acquire existing drawings as required to determine existing conditions. All existing underground utilities shall be supported and protected from damage. Contact proper authorities and/or the local “Call Before You Dig” utility service prior to excavation. If there are any major discoveries, bring them immediately to the attention of the Architect and Owner prior to excavation. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
2. Acquire and/or review survey of site and testing boring data to assist in determining soil content.
3. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation operations.
4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
5. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights. Where trenches cross roads, walks, or public thoroughfares, provide suitable barricades and bridges adequately protected by signs or red flags during day and lights at night.
6. Excavation shall be made to the proper depths. If excavation is carried below that required, the bottom shall be brought to the required elevation with sand fill, thoroughly compacted.
7. Slope sides of excavations to comply with local codes and ordinances.

8. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply with local codes and authorities. Shore and brace as required for stability of excavation. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Remove shoring and bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at an elevation of 30 inches below finished grade elevation.
9. Install sediment and erosion control measures, such as silt fences, in accordance with local codes and ordinances.
10. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
11. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage. Locate and retain soil materials away from edge of excavations. Do not store within drip-line of trees indicated to remain.
12. Remove off of Owner's property and legally dispose of excess excavated materials and trash, debris and waste materials not acceptable for use as backfill or fill.
13. Excavation for Underground Vaults and Electrical Structures: Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot; plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
14. Excavation for Equipment Pads: Provide excavation for concrete pad and required aggregate backfill according to contour lines provided by Civil Engineer.
15. Excavate, by hand, areas within drip-line of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter and larger with emulsified asphalt tree paint.
16. Excavate trenches to the uniform width, sufficiently wide to provide ample working room and a minimum of 6 inches clearance on both sides of raceways and equipment.
17. Limit the length of open trench to that in which installations can be made and the trench backfilled within the same day.
18. Where rock is encountered, first attempt to break up rock with rocker trencher, jackhammer, or other heavy machinery as required. Consult with Owner prior to using any explosive materials. Carry excavation below required elevation and backfill with a layer of crushed stone or gravel prior to installation of raceways and equipment. Provide a minimum of 6 inches of stone or gravel cushion between rock bearing surface and electrical installations.
19. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 deg F (1 deg C).
20. When excavation is required underneath an existing roadway, coordinate with Owner/Utility whether or not boring is required in lieu of excavation.
21. Where conduits pass below footings, install steel pipe sleeves (unless the conduits are required to turn up on the adjacent exterior wall) with at least 2"

clearance all around conduit and fill excavation to the bottom of the footing with concrete. Where conduits pass through subgrade walls, install steel pipe sleeves with at least 2" clearance all around conduit. Fill annular space around conduit with inorganic compressible filler to provide a watertight seal.

22. Where holes are to be drilled for direct buried poles or the like, use hand or machine powered auger to proper depth required by manufacturer.
23. Ducts shall be pitched to drain toward manholes and handholes and away from buildings and equipment. Minimum slope shall be 4 inches per 100 linear feet. Where necessary to achieve this between manholes, ducts shall be sloped from a high point in the run to drain in both directions.

C. Backfill:

1. Backfilling and Filling: Place soil materials in layers to required subgrade elevations for each area classification listed below, using materials specified below:

    a. Backfill around conduits in bottom of trench shall be clean sand, unless otherwise indicated to be concrete. Provide a 3” separation between each conduit and between the conduits and the trench. Utilize PVC base and intermediate spacers to accomplish separation. Secure spacers to trench and to conduits with tie wire to ensure conduits do not shift during backfill installation.
    b. Backfill above conduits to subgrade shall consist of existing suitable dirt backfill, unless otherwise noted. Existing backfill shall be free of trash, rock, or other debris. Existing excavated materials may be used in the sentence above, provided it can be readily compacted.
    c. Concrete backfill shall be required around conduits when feeder conduits (not for branch circuits, unless otherwise noted) pass under a roadway or parking lot or are otherwise indicated herein or on the drawings. Concrete reinforcing steel cages (of #4 rebar) are also required around concrete encased conduits when indicated herein or on the drawings. Where concrete encasing is required around the conduits passing underneath a roadway or parking lot, provide a course interlocking aggregate stone backfill above the concrete encasement to subgrade.

2. Backfill excavations as promptly as work permits, but not until completion of the following:

    a. Inspection, testing, approval, and locations of underground utilities have been recorded.
    b. Removal of concrete formwork.
    c. Removal of shoring and bracing, and backfilling of voids.
    d. Removal of trash and debris.

3. Place backfill and fill materials evenly adjacent to structures, conduit, and equipment to required elevations. Prevent displacement of raceways and equipment by carrying material uniformly around them to approximately same elevation in each lift.

4. Underground Line Warning Tape: Refer to Section 26 05 53 “Identification for Electrical Systems” for specific types of warning tape. Install warning tape during backfill at 6-8” below sub-grade.
5. Inspection: Backfilling shall not be made until wiring or conduit has been inspected by Architect/Engineer.

D. Compaction:

1. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification specified below. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
3. Compaction: Control soil compaction during construction, providing minimum percentage of density specified for each area classification indicated below.

    a. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density for soils which exhibit a well-defined moisture-density relationship (cohesive soils), determined in accordance with ASTM D 1557 and not less than the following percentages of relative density, determined in accordance with ASTM D 2049, for soils which will not exhibit a well-defined moisture-density relationship (cohesionless soils).

        1. Areas Other Than Under Building or Pavement: Compact top 6 inches of subgrade and each layer of backfill or fill material to 85 percent maximum density for cohesive soils, and 90 percent relative density for cohesionless soils.

    b. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water. Apply water in minimum quantity necessary to achieve required moisture content and to prevent water appearing on surface during, or subsequent to, compaction operations.

4. Subsidence: Where subsidence occurs at electrical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent areas.

3.8 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Division 26. Reestablish original grades, unless otherwise indicated. If sod has been

removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by excavation, trenching, storing of dirt, cable laying, cutting of roadway or sidewalk, and other activities to their original condition to the satisfaction of the Architect. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section 02 "Landscaping." Maintain restored surfaces.

3.9 INTENT OF DRAWINGS AND SPECIFICATIONS

A. The implied and stated intent of the drawings and specifications is to establish minimum acceptable quality standards for materials, equipment and workmanship, and to provide operable electrical and mechanical systems in every respect.

B. The drawings are diagrammatic only, intending to show general arrangement and location of system components. Due to the small scale of the drawings, and to unforeseen job conditions, all required offsets and fittings may not be shown, but shall be provided at no change in contract price.

C. All work shall be accurately laid out and coordinated with other trades to avoid conflicts and to provide maximum accessibility for operation and maintenance.

3.10 LUG RATINGS

A. All wiring lugs used throughout the project, including but not limited to: overcurrent protection devices, switchgear lugs, wiring device terminals, motor terminals, equipment terminals, etc. shall be rated for use with 75 degree minimum conductors.

3.11 PAINTING AND CAULKING

A. Coordinate and schedule painting of exposed raceways, boxes, and fittings with G.C. to avoid unnecessary trips by the G.C. and/or their subcontractor. All field painting shall be performed by the G.C. according to Division 09 “Finishes” unless otherwise noted herein or on the drawings.

B. Suitable finish coatings shall be provided under this section of the Specifications on all items of electrical equipment and wiring which are exposed. This shall consist of either an approved factory applied finish or an acceptable finish applied during or after installation. Equipment which is furnished in finishes such as stainless steel or satin aluminum is not to be painted. Exposed equipment and/or wiring in finished areas such as panel covers or surface raceway shall be supplied with factory applied prime coat and shall be professionally painted or enameled as directed to result in a completely coated and attractively finished manner. All such finishing shall be as directed and shall be satisfactory to the Architect/Engineer.

C. All factory-finished steel surfaces; boxes, enclosures, etc., shall be cleaned and retouched or repainted as necessary to provide a rust-resistant coating. Where painting or galvanizing is not specifically specified, ferrous devices, bolts, nuts, inserts, etc., shall be galvanized.

D. All nameplates and specially colored electrical equipment (such as fire alarm devices) shall be left unpainted and in a clean condition.

E. Coordinate installation of wiring devices and covers with G.C. to avoid overspray onto devices and/or covers. Provide temporary protection over the wiring devices, if installed ahead of painting, as required to prevent such overspray.

F. All caulking shall be performed by the G.C. unless otherwise noted herein or on the drawings. G.C. shall be responsible for caulking, and then painting, around all openings in walls that the G.C. cut larger then the device cover plate will cover up.

G. Where new electrical metallic equipment (i.e. surface raceway, conduit, boxes, panelboard tubs, etc. and not non-metallic surface raceway) is exposed on walls or ceilings to be painted, E.C. shall coordinate the timeliness of this work with the G.C. to ensure all is painted.

3.12 ROUGH-IN

A. In general, individual mounting heights of outlets, switches, etc. are not noted on the drawings. Details and notes specify “standard” mounting heights for these items. Contractor shall carefully study elevations of all walls and cabinet work as shown on architectural plans and locate outlets to given space and avoid all conflicts. Outlets shall always be located above, and not in, backsplashes. Coordinate location of outlets with other trades to avoid conflicts. Any conflict that cannot be resolved in the field shall be brought to the attention of the Architect prior to rough-in.

B. In general, the electrical drawing symbols and locations are not shown to an exact scale for legibility reasons. Field verify with Architect prior to rough-in, exact location and mounting heights of all electrical items such as switches, receptacles, clocks, speakers, call-in stations, fire alarm devices, nurse call stations, television outlets and associated receptacles, voice/data outlets, cctv monitors and cameras, floor boxes, poke-through assemblies, surface mounted raceways, wall mounted light fixtures, light poles, overhead projectors, etc., in all finished areas.

C. In general, where voice/data outlets and cable tv outlets and associated power receptacles are shown near each other but on separate plans, they shall be located adjacent to each other no more than 12” apart.

D. Verify with respective equipment supplier or Contractor prior to rough-in, exact location, electrical characteristics, and method of connection to respective equipment for such items as mechanical/plumbing/fire protection/kitchen/laundry/pool equipment, etc.

E. Where coursing of masonry block precludes the specified mounting height of an outlet such that the rough-in box would be located in the center of a cell, Contractor shall have the ability to adjust mounting heights slightly to work out with the coursing so that the rough-in box sits on the bottom or top of a course.

F. Refer to lintel schedule on Structural Drawings for requirements when penetrating wall with raceways.

3.13 SITE VISITS

A. All persons proposing to submit quotations for work in accordance with these plans and specifications are expected to visit the site of the work covered by the plans and specifications and are to familiarize themselves with existing conditions as they affect the work of this section of the specifications. Claims resulting from a failure to visit the site or inspect the existing conditions will not be considered. Existing wall/floor thicknesses and types shall be verified for required penetrations. Existing head-end equipment for low voltage systems being reused shall be verified by the prospective (sub) Contractors to ensure that they include any and all necessary equipment and programming costs in their Bid. Where existing switchgear is being modified or added onto, Contactor shall verify existing equipment and requirements for modifications/additions.

3.14 TEMPORARY PROTECTION OF ELECTRICAL EQUIPMENT

A. This contractor shall temporarily protect all electrical equipment from construction dust, dirt, debris, overspray, mud, etc. Contractor shall remove temporary covering for testing purposes and once the final building cleanup has been performed.

3.15 TEMPORARY POWER AND LIGHTING

A. The E.C. shall provide temporary 120/208/240 volt, single phase power for usage by all trades during construction until the permanent power is activated.

B. Temporary electrical panels shall be provided on each floor at a minimum or otherwise required to be reached from a 100’ extension cord.

C. Special three phase temporary power or circuits larger than 60 amps required by other trades shall be acquired through a portable generator from that specific trade and not from the E.C. unless they agree to do so at their expense.

D. Temporary power distribution shall be provided in the form of multiple 20 amp, GFCI receptacles at the temporary panels or 20 amp, GFCI circuit breakers.

E. Install and maintain temporary utilities according to OSHA requirements.

F. Remove all temporary wiring and receptacles upon activation to permanent power. Patch all temporary penetrations with approved compound.

G. Temporary services ran underground must be installed in conduit and the temporary conductors shall be removed when the permanent service is on line.

3.16 TEMPORARY POWER USAGE FEES

A. The Contractor, at his/her own expense, shall make arrangements for the purchase of power or portable power and provide (or coordinate with the Utility) for the extension of

Utility power to the point of usage. The usage costs of temporary electrical power shall be included in the Bid by the G.C., unless otherwise noted in Division 01.

END OF SECTION 26 05 00

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

B. Related Sections include the following:

1. Section 26 05 00 "Common Work Results for Electrical" for related firestopping work.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Wiring and Cabling: Listed by an “approved” third-party testing agency.

D. Comply with NEMA WC 3 for rubber insulated wire and cable, WC 5 for thermoplastic insulated wire and cable, and WC 7 for crosslinked polyethylene insulated wire and cable.

E. All wire and cable shall be listed by an “approved” third-party testing agency.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers:

1. American Insulated Wire Corp.; a Leviton Company.
2. Essex Electric.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

B. Conductor Material: Solid copper conductor for power and lighting circuits No. 10 AWG and smaller, copper stranded for power and lighting circuits No. 8 AWG and larger. Copper stranded conductors shall be allowed for all low voltage systems wiring.

C. Conductor Insulation Types: Type THHN-THWN, XHHW, and SO.

D. Maximum Conductor Size: Coordinate wire size with lug manufacturers.

E. Minimum Power and Lighting Conductor Size: #12 AWG.

F. Temperature Rating: All conductors shall be rated at 90 degrees C, unless otherwise noted.

G. Voltage Rating: Power wiring (120-480 Volts operating) must be 600 Volts. Low voltage systems wiring operating at 24 Volts or less can be 300 Volts, unless located in the same compartment as the power wiring.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. Ideal.
5. Ilsco.
6. O-Z/Gedney; EGS Electrical Group LLC.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

7. Thomas & Betts.
8. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Service Entrance: Type THHN-THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

F. Branch Circuits Concealed in Concrete and below Slabs-on-Grade: Type THHN-THWN, single conductors in raceway.

G. Underground Feeders and Branch Circuits: Type THHN-THWN, single conductors in raceway.

H. Class 1 Control Circuits: Type THHN-THWN, in raceway.

I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

3.2 INSTALLATION

A. Conceal cables within raceways, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Unless otherwise noted, all cables at exposed ceilings or walls shall be concealed in conduit. If allowed by Engineer, install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Where exposed cables are not installed in cable trays and allowed in other sections of the project documents, they shall be supported by j-hooks. J-hooks shall be sized according to the cable fill capacities published by the manufacturer and allowed by NEC and/or BISCI. J-hooks shall be supported by rigid all thread to the structure and not tie wire or ceiling wire. Cables shall not be supported by the following methods: strapped to outside of a cable tray, strapped to a conduit or pipe, lay on the ceiling surface, lay on structural supports, lay on light fixtures, etc.

F. Seal around cables penetrating fire-rated elements according to 260500 "Common Work Results for Electrical."

G. Seal around cables penetrating from roofs or from the exterior through a wall or floor with duct seal.

H. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

I. **Voltage Drop:** Conductors for branch circuits shall be sized to prevent a voltage drop exceeding three percent at the farthest outlet, fixture, motor, or equipment load. Conductors for panel feeder circuits shall be sized to prevent a voltage drop exceeding two percent at the panelboard. Total maximum voltage drop on both feeders and branch circuits to the farthest outlet shall not exceed five percent. **Voltage drop criteria specified in this paragraph and the table below shall override standard wire sizes for associated circuit breakers that may be shown on the panelboard schedules on the drawings.**

J. **Voltage Drop Table:** Using a 20 amp branch circuit as an example, all wiring shall be in accordance with the following minimal values listed in this table and as noted on the panel schedules:

Voltage:	Distance:	Home Run:	Remainder of Circuit:
120/208 V	0’ – 50’	#12	#12
	50’ – 100’	#10	#12
	100’ – 150’	#8	#10
	150’ – 250’	#6	#10
277/480 V	0’ – 125’	#12	#12
	125’ – 220’	#10	#12
	220’– 330’	#8	#10

K. Provide no more than three current carrying conductors (hot circuits), three dedicated neutral conductors, and one equipment grounding conductor in any conduit homerun, unless directed by this Engineer.

L. The number of conductors in each run of conduit is indicated on the drawings and where there is a conflict between the number of wires indicated and the actual number required as determined by the functional design requirements, the number of wires determined by the functional design requirements shall govern.

M. The branch circuit wiring has been designed to utilize the advantages of multi-wire (3H + 3N + 1G) distribution and shall be installed substantially as indicated on the drawings. No major changes in the grouping or general routing of the branch circuits shall be made without the approval of the Engineer in writing. Branch circuit changes, once made, shall be updated on the as-built drawings and panelboard directories.

N. Install a dedicated neutral conductor for each phase (hot) conductor for each dimmed lighting circuits.

O. Install a dedicated neutral conductor for each GFI branch circuit.

3.3 CONNECTIONS

A. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

B. Install electrical connections in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating and mechanical strength, than electrical insulation rating of those conductors being spliced.

E. Prepare wires/cables, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where wires/cables are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

F. Trim wires/cables as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

H. Joints in solid conductors shall be spliced using Ideal “wirenuts”, 3M Company “Scotchlok”, or T&B “Piggy” connectors in indoor and dry location junction boxes, outlet boxes, and lighting fixtures.

I. Joints in stranded conductors shall be spliced by approved mechanical connectors (such as split bolts) and gum rubber tape or friction tape. Solderless mechanical connectors for splices and taps, provided with UL approved insulating covers, may be used instead of mechanical connectors plus tape.

J. Joints in outdoor locations such as handholes, pole light bases, ground mounted light fixtures, wireways, junction boxes, etc. shall be spliced by approved mechanical connectors, such as split bolts and gum rubber tape or friction tape or “Ilsco” type connectors.

K. “Sta-kon” style permanent crimp ring or fork connectors **[shall] [shall not]** be used for stranded conductor branch circuit connections.

L. Conductors, in all cases, shall be continuous from outlet to outlet, device to device, box to box, etc. and no splicing shall be made except within outlet or junction boxes, troughs, and gutters.

M. Train and route cables terminating in a loadcenter, panelboard, switchboard, switchgear, etc. directly from the raceway to the respective termination point (OCPD or bar) with as few bends as possible. Bend the cable prior to termination neatly and consisting with bend radius according to manufacturer’s recommendations.

N. Provide a minimum 12” slack loop on all low voltage devices prior to termination at the device.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
3. Lighting tests for the Sports Lighting per Section 26 56 68.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
4. Provide copy of test reports in the O&M closeout information.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:

1. Section 26 05 19 “Low-Voltage Electrical Power Conductors and Cables” for grounding cable work.
2. Section 26 27 26 “Wiring Devices” for grounding work relating to these devices.
3. Division 26 Sections relating to “Switchgear” for grounding work relating to these pieces of equipment.

1.3 DEFINITIONS

A. Test Well: A below-the-surface enclosure used in connection with accessing ground rod connections in non-grassy surface areas into which an individual can reach, but not enter, for the purpose of installing, maintaining or operating equipment or wiring.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

C. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Testing equipment make, model, and serial number along with date last calibrated.
3. Test results that comply with requirements.
4. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

B. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

C. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:

a. Apache Grounding/Erico Inc.
b. Chance/Hubbell.
c. Erico Inc.; Electrical Products Group.
d. Harger Lightning Protection, Inc.
e. Heary Brothers Lightning Protection Co.
f. Ideal Industries, Inc.
g. ILSCO.
h. Kearney/Cooper Power Systems.
i. O-Z/Gedney Co.; a business of the EGS Electrical Group.
j. Raco, Inc.; Division of Hubbell.
k. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Material: Copper.

C. Equipment Grounding Conductors #6 AWG and smaller: Insulated with green-colored insulation the entire distance.

D. Equipment Grounding Conductors #4 AWG and larger: Insulated with black-colored insulation the entire distance and taped with green tape at all exposed or accessible locations.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

G. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

H. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
2. Bonding Conductor: No. 4 AWG minimum, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

I. Ground Conductor and Conductor Protector for Wood Poles: As follows:

1. No. 4 AWG minimum, soft-drawn copper conductor.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir, or cypress or cedar.

J. Grounding Buss:

1. Bare, electrolytic tough pitch 10 alloy copper bars of rectangular cross section.
2. 2-3/4” deep stand-off insulators constructed of glass reinforced thermoset polyester.
3. Wall mounted with 3/8” hardware.
4. Minimum size of 12” x 4” x 2-3/4” using ¼” buss bar.
5. 7/16” diameter lug holes.
6. Spacing of lugs to be three (3) rows of five (5) columns. Center to center spacing to be ¾”, 1”, and 1-3/4” for two hole grounding lugs.
7. Meets UL467.

2.3 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Two hole, irreversible compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES

A. Ground Rod Material: Copper-clad steel.

B. Ground Rods: Sectional type, when required to achieve proper grounding measurement.

1. Size: 3/4 by 120 inches (19 by 3000 mm) in diameter.

C. Ground Plate Material: Copper bronze with tabs for ground wire connection.

D. Ground Plate Size: 24” x 24” x 1/4” thick.

E. Chemical Electrodes: Copper tube, straight or L-shaped, filled with nonhazardous chemical salts, terminated with a 4/0 bare conductor. Provide backfill material recommended by manufacturer.

2.5 TEST WELLS

A. Test Well Description:

1. Heavy duty high traffic area test well constructed from 12-3/4" OD concrete.
2. Each test well comes with a cast iron lid marked "Ground" and has a cast iron ring to support the lid. Lids shall be provided with security bolts.
3. Test well base length to extend past the frost line depth.

PART 3 - EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

F. Grounding Bus: Install in all electrical and telecommunications equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Use insulated spacer; space 1 inch (25.4 mm) from wall and support from wall 6 inches (150 mm) above finished floor, unless otherwise indicated.
2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.

G. Underground Grounding Conductors: Use copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade or bury 12 inches (300 mm) above duct bank when installed as part of the duct bank.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all conduits for circuits over 100 volts, except service entrances, telecommunications, and audio/video conductor raceways.

C. Busway Supply Circuits: Install insulated equipment grounding conductor from the grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for low voltage system cables or designated as service entrance raceways.

E. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners and heaters. Bond conductor to each unit and to air duct.

F. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install an equipment grounding conductor to each electric water heater, heat-tracing, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.

G. Signal and Communication Systems: For voice and data equipment rooms, and other communication systems head end equipment, provide No. 6 AWG minimum insulated grounding conductor in raceway from main building service grounding electrode system to each service location, terminal cabinet, wiring closet, central equipment location, and/or supplemental telecommunications room grounding bus bar.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-10-inch (6.4-by-101.6-by-254-mm) copper grounding bus bar.
2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

H. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

I. Common Ground Bonding with Lightning Protection System: Bond main building service grounding system directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

J. Service Entrance Panels: Provide bonding bushings and bonding conductors between bushings and equipment ground bar for any rigid steel conduits that are stubbed up into the bottom of the panel.

3.3 INSTALLATION

A. Ground Rods: Install at least one rod at the service entrance (or three if shown on a drawing detail). Provide additional rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, as required to meet maximum ground rod resistance criteria of 25 ohms.

1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.
3. Where soil conditions preclude the installation of ground rods, ground plates may be installed. The ground plates shall be a minimum of 30” deep BFG.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance. Provide bonding jumpers at all steel expansion joints for continuity. Bonding jumpers shall be used around concentric or eccentric knockouts that are punched or otherwise formed so as to impair the electrical connection to ground.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to within 5’ from where the main metal water service entrance is to the building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Structural Steel: Provide exothermic connection to a structural steel member and connect to the main electrical service grounding bar. Provide bonding jumpers at each and any structural steel expansion joint and point where steel is not entirely connected together.

G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

H. Where a ground rod connection is buried below a finished concrete or asphalt area, install a test well for each ground rod. Set top of well flush with finished grade or floor.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
6. Scrape off painted finish to expose steel surface on structure and water piping when making bonding connections.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other

standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
2. Test grounding system at each location where a maximum ground-resistance level is specified: at each ground rod, at service disconnect enclosure grounding terminal, and at ground test wells. Disconnect the ground conductor from the ground rods to the main service ground reference point, prior to testing. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests in all new buildings or additions, by the three point fall-of-potential method according to IEEE 81. Perform tests in all existing buildings, by the two point method.
3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Include nameplate information from testing equipment and last date calibrated. Describe measures taken to improve test results.

    a. Maximum Reading: 25 ohms.

4. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and provide additional ground rods to achieve specified rating.

END OF SECTION 26 05 26

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 and all Division 26 Specification Sections, apply to this Section.

B. Related Sections include the following:

1. Section 26 05 00 "Common Work Results for Electrical" for concrete foundation work.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Vibration isolation requirements for electrical equipment and systems.
3. Seismic restraints for electrical equipment and systems.
4. Construction requirements for concrete bases.
5. Vertical cable supports.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. Seismic Restraint: A structural support element such as a metal framing member, a cable, an anchor bolt or stud, a fastening device, or an assembly of these items used to transmit seismic forces from an item of equipment or system to building structure and to limit movement of item during a seismic event.

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support and seismic-restraint component used.

1. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
2. Annotate to indicate application of each product submitted and compliance with requirements.

B. Shop Drawings: Indicate materials and dimensions and identify hardware, including attachment and anchorage devices, signed and sealed by a qualified professional engineer. Include the following:

1. Fabricated Supports: Representations of field-fabricated supports not detailed on Drawings.
2. Seismic Restraints: Detail anchorage and bracing not defined by details or charts on Drawings. Include the following:

a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
b. Details: Detail fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events.
c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC and SMACNA, as dictated by the Architectural/Structural Engineering drawings, unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Vertical Cable Supports: Comply with NEC Article 300.19.

1.6 PROJECT CONDITIONS

A. Seismic Design Category as Defined in the IBC: See Civil Drawings.

A. Seismic Use Group as Defined in the IBC: See Civil Drawings.

B. Seismic Importance Factor: 1.0 for all non-life safety equipment.

C. Verify all seismic criteria with Civil Engineer prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified below.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project. Verify with Structural Engineer the minimum structural safety factor times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

1. Manufacturers:

a. Cooper B-Line; a division of Cooper Industries.
b. ERICO International Corporation.
c. Allied Support Systems; Power-Strut Unit.
d. GS Metals Corp.
e. Michigan Hanger Co., Inc.; O-Strut Div.
f. Thomas & Betts Corporation.
g. Unistrut; Tyco International, Ltd.

2. Finishes:

a. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
b. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-3.
c. Painted Coatings: Manufacturer's standard green painted coating applied according to MFMA-3.

3. Size: 1-5/8” x 1-5/8”, 12 gauge, minimum.

C. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.

1. Manufacturers:

a. Allied Support Systems; Aickinstrut Unit.
b. Cooper B-Line; a division of Cooper Industries.
c. Fabco Plastics Wholesale Limited.

d. Seasafe, Inc.

2. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
3. Fitting and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
4. Rated Strength: Selected to suit structural loading and applicable seismic forces.
5. Size: 1-5/8" x 1-5/8", 12 gauge, minimum.

D. Raceway and Cable Supports: As described in NECA 1.

E. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

F. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

G. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

H. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used. Provide anchors that are seismically approved and properly selected, based on design calculations through the center or gravity. Anchor bolts must be embedded and spaced in accordance with ICBO standards.

a. Manufacturers:

1) Cooper B-Line; a division of Cooper Industries.
2) Hilti, Inc.
3) ITW Construction Products.
4) MKT Fastening, LLC.
5) Powers Fasteners.

2. Concrete Inserts: Steel or malleable-iron slotted-support-system units similar to MSS Type 18; complying with MFMA-3 or MSS SP-58.
3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
4. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.
5. Toggle Bolts: All-steel springhead type for hollow masonry walls.
6. Hanger Rods: Threaded steel.
7. Drop-In Anchors: Carbon steel with bolt insert for solid concrete walls and floors.
8. Nail-In Anchors: Zamac alloy with carbon steel drive pin.

9. Machine Screws or Self-Tapping/Self-Drilling Screws: For metal surfaces.
10. Wood Screws: For wood construction.

2.3 SEISMIC-RESTRAINT COMPONENTS

A. Rated Strength, Features, and Application Requirements for Restraint Components: As defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project. Verify with Structural Engineer the minimum structural safety factor times the applied force.

B. Angle and Channel-Type Brace Assemblies: Steel angles or steel slotted-support-system components; with accessories for attachment to braced component at one end and to building structure at the other end.

C. Cable Tray Restraints: Provide separate 45 degree angled bracing to the structure every 30 linear feet and at each change in direction.

D. Cable Restraints: ASTM A 603, zinc-coated, steel wire rope attached to steel or stainless-steel thimbles, brackets, swivels, and bolts designed for restraining cable service.

1. Manufacturers:

a. Amber/Booth Company, Inc.
b. Loos & Co., Inc.
c. Mason Industries, Inc.

2. Seismic Mountings, Anchors, and Attachments: Devices as specified in Part 2 "Support, Anchorage, and Attachment Components" Article, selected to resist seismic forces.
3. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod, of design recognized by an agency acceptable to authorities having jurisdiction.
4. Bushings for Floor-Mounted Equipment Anchors: Separate double acting seismic snubbers with Neoprene cushioned interfaces designed for seismically rated rigid equipment mountings, and matched to type and size of anchor bolts and studs used.
5. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to type and size of attachment devices used.

2.4 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. It is not the intent of these documents to clearly indicate every individual hanger and support required. Contractor shall provide hangers and supports as required for manufacturer's recommendations and code requirements.

B. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for conduit as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction
2. Secure raceways and cables to these supports with two-bolt conduit clamps single-bolt conduit clamps single-bolt conduit clamps using spring friction action for retention in support channel.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

F. Use steel slotted U-channel in most all applications, except corrosive, wet, and outdoor locations where nonmetallic shall be used.

3.2 SUPPORT AND SEISMIC-RESTRAINT INSTALLATION

A. Comply with NECA 1 and Civil Engineering drawings and specifications for installation requirements, except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, conduit may be supported by openings through structure members, as permitted in NFPA 70. Conduits sized 2-1/2" and larger to have special seismic support design including angle iron type bracing.

C. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.

D. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, pneumatic-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick. Verify with Structural Engineer prior to installation.
6. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements. Install additional blocking in metal stud walls to support heavy wall mounted equipment such as transformers, distribution panelboards, transfer switches, etc.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

G. Junction and outlet boxes: Provide two studs to secure box to wall or ceiling in lieu of one.

H. Support all ceiling mounted equipment independently to the building structure (i.e. recessed light fixtures, recessed ceiling speakers, etc.). Provide at least four twists on the ceiling wire when tying up a piece of equipment.

I. Conductor Support Methods in Vertical Pole Raceway: Refer to NEC Article 300.19 and table 300.19(A) for conductor sizes and associated support intervals.

J. In seismic areas, conduit 2-1/2” and larger must be braced, when supported more than 12” below structure.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and seismic criteria at Project.

B. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so expansion anchors will be a minimum of 10 bolt diameters from edge of the base.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of the base.
2. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use supported equipment manufacturer's 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. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
6. Use 2500-psi (17.2-MPa), 28-day compressive-strength concrete for all concrete ductbanks. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete for all transformer pads. Use 4000-psi (27.6-MPa), 28-day compressive-strength concrete for all light pole bases. Concrete materials, reinforcement, and placement requirements are specified in Section 260500 "Common Work Results for Electrical."

C. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Restraint Cables: Provide slack within maximums recommended by manufacturer.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.5 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic-control joints, where adjacent sections or branches are supported by different structural elements, and where they

terminate with connection to electrical equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing: Test pullout resistance of seismic anchorage devices.

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Record test results.

END OF SECTION 26 05 29

SECTION 26 05 33 – RACEWAYS, BOXES, AND FITTINGS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, cabinets for electrical wiring.

B. Related Sections include the following:

1. Section 26 05 00 "Common Work Results for Electrical" for supports, anchors, identification products, access panels, and firestopping.
2. Section 26 05 29 "Hangers and Supports for Electrical Systems" for seismic restraints and bracing of raceways, boxes, enclosures, and cabinets.
3. Section 26 27 26 "Wiring Devices" for devices.

1.3 ABBREVIATIONS/DEFINITIONS

A. AC: Armored cable.

B. Duct Bank: A group of two or more ducts in a continuous run between two points.

C. EMT: Electrical metallic tubing.

D. ENT: Electrical nonmetallic tubing.

E. FMC: Flexible metal conduit.

F. GRC: Galvanized rigid steel conduit.

G. IMC: Intermediate metal conduit.

H. LFMC: Liquidtight flexible metal conduit.

I. MC: Metal clad cable.

J. PVC: Polyvinylchloride conduit.

K. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For conduit fittings, surface raceways and components, wireways and fittings, hinged-cover enclosures, and cabinets.

B. Shop Drawings: Signed and sealed by a qualified professional engineer.

1. Design Calculations: Calculate requirements for selecting seismic restraints.
2. Detail assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

C. Manufacturer Seismic Qualification Certification: Submit certification that enclosures, cabinets, accessories, and components will withstand seismic forces defined in Section 26 05 29 "Hangers and Supports for Electrical Systems". Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT, TUBING, AND FITTINGS

A. Manufacturers:

1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose.
4. Electri-Flex Co.
5. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company.
7. Manhattan/CDT/Cole-Flex.
8. O-Z Gedney; Unit of General Signal.
9. Shamrock.
10. Wheatland Tube Co.

B. Galvanized Rigid Steel Conduit: ANSI C80.1.

1. Fittings: Use heavy duty threaded double locknut rigid steel conduit fittings along with thermoplastic bushings in a non-threaded hub installation, unless otherwise indicated. Set screw fittings are not permitted.

C. IMC Conduit: ANSI C80.6.

1. Fittings: Use heavy duty threaded double locknut rigid steel conduit fittings along with thermoplastic bushings in a non-threaded hub installation, unless otherwise indicated. Set screw fittings are not permitted.

D. Plastic-Coated Galvanized Steel and IMC Conduit Fittings: NEMA RN 1.

1. Fittings: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits. Set screw fittings are not permitted.

E. LFMC: Liquidtight flexible steel conduit with PVC jacket.

1. Fittings: Malleable iron, zinc plated, compression type with insulated throat. Die cast are not permitted.

2.3 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers:

1. American International.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Arnco Corp.
4. Cantex Inc.
5. Certainteed Corp.; Pipe & Plastics Group.
6. Condux International.
7. ElecSYS, Inc.
8. Electri-Flex Co.

9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT/Cole-Flex.
11. RACO; Division of Hubbell, Inc.
12. Southern Pipe Company.
13. Spiralduct, Inc./AFC Cable Systems, Inc.
14. Thomas & Betts Corporation.

B. ENT: NEMA TC 13.

C. Rigid Non-Metallic Ducts and Fittings, Schedule 40 and 80: NEMA TC-2, Federal Specifications WC 1094A and UL 651 and to be UL listed.

D. Rigid Non-Metallic Ducts and Fittings, Type EB-20 (For Concrete Encasement): Tested to UL-651-A, ETL listed, NEMA TC-6 and ASTM F-512.

E. Rigid Non-Metallic Ducts and Fittings, Type EB-35 (For Concrete Encasement): NEMA TC-8 and ASTM F-512.

F. Rigid Non-Metallic Ducts and Fittings, Type DB-60 (For Direct Burial or Concrete Encasement): NEMA TC-6, ASTM F-512.

G. Rigid Non-Metallic Ducts and Fittings, Type DB-120 (For Direct Burial or Concrete Encasement): NEMA TC-8, ASTM F-512.

H. ENT and RNC Fittings: NEMA TC 3; match to conduit or tubing type and material as recommended by respective manufacturer.

I. Non-metallic conduit solvents and sealants to be as recommended by manufacturer of respective conduit manufacturer.

2.4 METAL WIREWAYS

A. Manufacturers:

1. Cutler Hammer.
2. Hoffman.
3. Square D.

B. Material and Construction: Sheet metal sized, shaped, and NEMA rating as indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Hinged type for indoor. Flanged-and-gasketed type for outdoor.

F. Finish: Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS

A. Manufacturers:

1. Hoffman.
2. Lamson & Sessions; Carlon Electrical Products.
3. Stahlin.

B. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

2.6 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.

1. Manufacturers:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Walker/Wiremold Company (The).
c. Thomas & Betts/Steel City Corporation.

B. Surface Nonmetallic Raceways: Two-channel construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color as selected by Architect.

1. Manufacturers:

a. Panduit “T-70” series.
b. Wiremold “40N2” series.
c. Steel City.

C. Types, sizes, and channels as indicated and required for each application.

D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, dividers, covers, wire supports, external 90s, internal 90s, entrance end fittings, and other fittings to match and mate with wireways as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company.
3. Erickson Electrical Equipment Co.
4. Hoffman.
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal.
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet-PLM Division.
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinged cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

H. Where concentric, eccentric or over-sized knockouts are encountered, a bonding bushing shall be provided.

2.8 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:

1. Exposed: GRC or IMC.
2. Concealed: GRC or IMC.
3. Underground, Single Run: RNC.
4. Underground, Grouped: RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R.

B. Minimum Indoor Non-Flexible Raceway Size: **3/4-inch trade size (DN 20)**. Minimum Outdoor Raceway Size: 1**-inch trade size (DN 25)**. Obey these dimensions despite what might be indicated on the panelboard schedules on the drawings.

3.2 INSTALLATION

A. Electrical raceways shall be supported independently from any other trade's supports or existing supports to the structure. E.C. shall provide strut as required between beams or bar joists that span between a required support location. E.C. shall provide strut as required underneath elements such as ductwork to independently support their electrical equipment, such as light fixtures.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Section 26 05 29 "Hangers and Supports for Electrical Systems".

E. Install temporary closures to prevent foreign matter from entering raceways, boxes, panels, light fixtures, smoke detectors, etc. during construction. Provide duct tape over masonry rough-in boxes during construction to prevent mortar and other debris from entering box. Remove all temporary protection for final device trim out and when the job conditions are conducive.

F. Protect stub-ups from damage where conduits rise through floor slabs. Coordinate depth of conduits penetrating above/below footings with the structural drawings to ensure proper bend radius when conduit turns up through floor. Arrange so that no part of the bend in the conduit shall be visible from above the floor.

G. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

H. Change from nonmetallic tubing to GRC or IMC before rising above grade to a utility pole or service entrance.

I. Install exposed and concealed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

1. Run parallel or banked raceways together on common supports.
2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

J. Join raceways with fittings designed and approved for that purpose and make joints tight.

1. Use insulating bushings to protect conductors.

K. Tighten set screws of threadless fittings with suitable tools.

L. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two heavy-duty locknuts, one inside and one outside box.
2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

M. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Label pull wire at origination end (i.e. cable tray or panelboard).

N. Pull or Junction Boxes: Install raceways in maximum lengths of 150 feet (45 m). Install telecommunication conduits with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes, along with access panels if required, where necessary to comply with these requirements.

O. Non-Hazardous Locations: Install raceway seal-off fittings at suitable, approved, and accessible locations and fill them with UL-listed ductseal compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces and penetrations outside of building including roof.
2. Where otherwise required by NFPA 70.

P. Stub-up Connections: Extend conduits through concrete floor for connection to surface mounted or freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conduits to the

equipment (such as surface mounted panelboards) with rigid steel conduit; LFMC may be used 6 inches (150 mm) above the floor to vibrating equipment. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections. When transitioning up from underground slab on grade below to above grade (whether exposed or concealed), provide rigid steel conduit ells.

Q. Flexible Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations and connections to pumps. Install separate ground conductor across flexible connections. Tie up flexible conduit light fixture whips above ceiling with metal clips such as made by Caddy or tie wire to the structure so that it does not rest on the ceiling.

R. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals. Verify mounting height with architect on all surface raceways prior to rough-in. All surface raceways are to be supported a minimum of every eight (8) linear inches with one anchor for single compartment raceway and two separate anchors for dual compartment raceway. Where surface raceways butt up against each other at an intersecting wall or around a column, Contractor shall use factory internal and external radius fittings and not stop the raceways and butt them up against each other.

S. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

T. Separate raceways: Provide separate raceways for conductors of different voltage systems (i.e. 480/277 volt versus 208/120 volt versus sub 100 volt systems).

U. Burial Depth: Exterior branch circuit conduits in grassy areas shall have a minimum cover of 24 inches. Exterior feeder and service entrance conduits in grassy areas shall have a minimum cover of 36 inches. Exterior conduit ductbanks encased in concrete shall have a minimum cover of 30 inches. Coordinate burial depths with contour lines and new elevations indicated on the drawings.

V. In general, all conduits passing under concrete or asphalt roads, parking lots, driveways, etc. shall be encased in concrete. Refer to the drawings for other exact locations of concreted encased ductbanks.

W. Conduit Fittings: The use of condulets shall minimized. Provide cast iron body and gasketing for all exterior uses and aluminum and gasketing for all interior uses. Where necessary to use condulets sized above 2”, mogul units shall be installed. Notify Engineer prior to installation. The use of conduit pulling fittings is not permitted. A short 180 degree “u-shaped” bend between two adjacent rough-in boxes is not an acceptable solution.

X. Service entrance conduit penetrations and entrances into buildings to be in galvanized steel, heavy wall conduit. Transform from non-metallic ducts to steel at a minimum of 10 feet from building. Use fittings manufactured for the purpose.

Y. Concrete-encased conduits to have reinforcing steel when passing through excavations and disturbed earth. Coordinate duct bank with structural design at wall so duct bank is supported at wall without reducing structural or watertight integrity.

Z. Non-encased, direct buried exterior conduits entering non-waterproofed walls to have a galvanized, heavy wall steel pipe sleeve for each duct installed by the Electrical Contractor. Caulk sleeve between sleeve and conduit with duct sealing compound on both sides for moisture-tight seal, to satisfaction of Architect.

AA. Where exterior conduits enter a building or structure through a waterproofed floor or wall or below grade, provide a watertight entrance-sealing device, with sealing gland assembly on the inside. Refer to Section 260500 "Common Work Results for Electrical" for information regarding these sleeves. Device to be securely anchored into the masonry construction with one or more integral flanges and membrane waterproofing secured to the device in a permanently watertight manner.

BB. Where conduits are indicated to be non-metallic, stub-ups to be galvanized heavy wall steel and to extend 5 feet away from pad or equipment. Encase with 3-inch concrete envelope. Provide insulating bushings on stubs.

CC. Provide temporary closure at all ends of exterior conduits which are to be active. Spare exterior conduits to have permanent seals at all openings, to allow for future use. Sealing compound and plugs to withstand 15 psi minimum hydrostatic pressure.

DD. Deliver conduits to site with ends capped, and store with supports to prevent bending, warping and deformings.

EE. Wireways: Provide metallic wireways for all indoor dry applications.

FF. Where a conduit penetrates a wall and must be terminate at a surface mounted junction box, the junction box shall not be located off of the wall the depth of the conduit connector or more. The vertical conduit shall be terminated in a flush junction box and the box shall be brought out to the surface with (an) extension ring(s) for continuation of the conduit. Junction boxes that are spaced off a wall more than the length of a conduit connector are not acceptable, unless structural conditions do not permit this installation.

GG. Maintain 3” minimum spacing between conduits in a ductbank and between conduits and the edge of the ductbank with PVC intermediate spacers. Maintain 3” minimum spacing between the lowest row of conduits in a ductbank and the earth with PVC base spacers. Conduits and PVC spacers shall be securely anchored during concrete placement in a ductbank to prevent movement through the use of rebar and non-metallic fasteners such as nylon zip ties. Provide spacers to prevent sags in conduit at least every 10 feet.

HH. Secure vertical conduits along wall entering or exiting distribution equipment through the use of strut and strut straps.

II. Where conduits of any type pass over a building expansion joint, a standard “expansion joint fitting,” compatible with the type raceway being used, shall be provided.

JJ. Waterproof marking cord with 130 lb tensile strength and marked every ten feet shall be installed in all exterior underground ducts, including spares, after thoroughly rodding, clearing, and swabbing all lines free of any and all obstructions.

KK. Exterior underground ducts shall be sealed at terminations, using sealing compound and plugs, as required to withstand 15 psi minimum hydrostatic pressure.

LL. All electrical devices shall be mounted to an approved electrical rough-in box, unless otherwise noted.

MM. Junction boxes suspended more than 36” from a wall or ceiling, require a dedicated minimum ¼” all thread support to the structure.

NN. Obey the NEC for all minimum conduit support distances.

OO. Flexible conduit installed above ceilings for light fixture whips shall not touch the ceiling grid and shall be supported by the use of a caddy clip or tie wire.

PP. For all exterior conduits mounted on flat rubber roofs or ran along ground in aggregate base (such as a mechanical courtyard), provide 4” x 4” wood blocking with rubber bases or Styrofoam blocking with insert for strut support at a maximum of every 7 feet for each conduit support and secure conduit to blocking with two hole conduit strap on wood block or strut strap on Styrofoam blocking.

QQ. All conduit shall be rigidly supported with either one hole straps, two hole straps, minerallac straps, strut straps, etc. Conduit shall not be supported with tie wire, ceiling wire, or tape.

RR. The electrical drawings do not specifically indicate gypsum board thickness or wall thickness. The Contractor shall coordinate and provide all required plaster rings, masonry rings, extensions, etc. for a flush outlet box rough-in with the wall thickness.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

B. Wipe down all exposed surface raceways.

C. Clean out all floor boxes for dust and debris.

D. Rod all underground conduits with a mandrel 1/4-inch smaller in diameter than the internal diameter of respective duct, prior to backfill. Remove any indicated obstructions.

END OF SECTION 26 05 33

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Identification for conductors and communication and control cable.
2. Underground-line warning tape.
3. Equipment identification labels.
4. Miscellaneous identification products.

B. Related Sections include the following:

1. All relevant Division 26 Sections for identification types.
2. Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for conductor insulation colors.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: A proposed index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project with respect to corresponding trade involved. Verify finalized room naming/numbering with Owner prior to production of labels.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

E. Coordinate existing labeling scheme with Owner, if applicable, including colors and description.

PART 2 - PRODUCTS

2.1 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.

E. Write-On Tags: Polyester tag, 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.

1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.

1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core to be utilized as a tracer.
4. Printed legend shall indicate specific type of underground line.

2.3 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

B. Stenciled Legend: In nonfading, waterproof ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.6 kg), minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: White, except where used for color-coding.
5. Plenum Rated: For use in plenum rated ceilings, i.e. voice/data cabling in cable tray.

B. Paint: Paint materials and application requirements are specified in Division 09 Painting Sections.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 APPLICATION

A. Power-Circuit Conductor Identification: For primary and secondary conductors in vaults, outdoor pull and junction boxes, manholes, and handholes use color-coding conductor tape and metal tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

B. Branch-Circuit Conductor Identification: Where there are feeders with black insulation in same junction box, pull box, or switchgear termination, use color-coding conductor marker tape. At each pull box, outlet box, junction box, and termination at source, identify each ungrounded conductor according to source and circuit number via alpha-numeric “Brady” label stickers.

C. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source and circuit number.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Install underground-line warning tape for both direct-buried cables and cables in raceway.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.

G. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer or load shedding.

H. Equipment Identification Labels: On each unit of equipment, install unique (non-standard) designation label that is consistent with label details on the drawings, wiring diagrams, schedules from associated equipment discipline, and Operation and Maintenance Manual.

1. Labeling Instructions:

a. Manufacturer’s standard panelboard labels are not acceptable. Refer to details on drawings for specific requirements.
b. Indoor Equipment: Engraved, Laminated Acrylic or Melamine Label with 3/8 inch (9.5 mm) high minimum letters.

c. Outdoor Equipment: Stenciled legend with 4 inch (100 mm) high minimum letters.
d. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Label Colors

a. 480/277 volt, normal power: white letters on black background.
b. 208/120 volt, normal power: white letters on blue background.
c. Where equipment contains both 480 and 208 volt power, provide labels corresponding to 480 volt. Where equipment contains both normal and emergency power, provide labels corresponding to emergency.

3. Equipment to Be Labeled:

a. Panelboards, electrical cabinets, and enclosures.
b. Electrical switchgear.
c. Transformers.
d. Disconnect switches.
e. Enclosed circuit breakers.
f. Push-button stations.
g. Contactors.
h. Remote-controlled devices.
i. Monitoring and control equipment.
j. Remote electrical enclosures

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device. Only utilize self-adhesive type labels where fasteners cannot penetrate the substrate, i.e. dead fronts of distribution panels where the fastener could penetrate a circuit breaker.

E. Attach nonadhesive signs and plastic labels with stainless steel self tapping screws and auxiliary hardware appropriate to the location and substrate.

F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG, field applied.
2. Colors for 208/120-V and 240/120-V Circuits:

   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.
   d. Neutral: White.
   e. Equipment Ground: Green.

3. Colors for 480/277-V Circuits:

   a. Phase A: Brown.
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray.
   e. Equipment Ground: Green.

4. Colors for switchleg or traveler conductors: Same as the circuit being switched with additional white bands of tape (1 for switchleg, 2 for traveler) at outlet box or junction box.

5. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where multiple types of services are installed in a common trench. The lettering or verbage on the warning tape shall match the description of the underground service installed below as close as possible.

J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections for all junction box interiors and junction box covers according to the color scheme listed above in Section 3.1.

K. Owner: Coordinate any Owner mandated electrical identification or extension of Owner's existing electrical identification system.

L. All spare conduits and conduits and junction boxes with spare circuits shall be clearly identified for future use and shall indicate where they terminate. Identification for spare conduits shall be accomplished by the use of tags with pull string attached to the conduit or junction box.

END OF SECTION 26 05 53

SECTION 26 05 95 – SERVICE ENTRANCE

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.

B. Related Sections include the following:

1. Division 26 Section 26 05 00 "Common Work Results for Electrical" for work relating to excavation, backfill, compaction, concrete, delivery, storage, handling, floor and wall seals and sleeves.
2. All relevant Division 26 Sections relating to switchgear.
3. Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for work relating to 600V and below cables.

1.2 DEFINITIONS

A. Power Company: BEMC.

1.3 SUMMARY

A. The Owner will pay all charges levied by the Power Company for the electrical service, unless otherwise noted. The Contractor shall assist the Owner with the application and timing for the electrical service.

B. Electrical primary power service will be supplied by the local Power Company.

C. Electrical secondary power service will be supplied by the local Power Company up to and including the Transformer.

D. The electrical characteristics of the primary power service are underground, 3-phase, 4-wire, 60 Hz.

E. The electrical characteristics of the secondary power service are underground, 480/277 V, 3-phase, 4-wire, 60 Hz.

F. Verify exact location of pad-mounted service transformer during the bidding period, with the Power Company.

1.4 SUBMITTALS

A. Equipment fault current ratings shown on the drawings are based on preliminary information provided by the Power Company and are shown for bidding purposes only. Exact available fault current values at the service connection point will be determined by the Power Company after the project is awarded. Verify equipment fault current interrupting capacity requirements prior to submitting electrical distribution equipment. Provide a copy of the Power Company's calculated maximum available fault current to the Architect.

1.5 QUALITY ASSURANCE

A. Provide service-entrance equipment and accessories which are UL-listed and labeled, and marked, "SUITABLE FOR USE AS SERVICE EQUIPMENT."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 GENERAL

A. All materials shall be in accordance with the Power Company requirements and as specified.

2.3 SERVICE ENTRANCE EQUIPMENT

A. Provide service entrance equipment and accessories; of types, sizes, ratings and electrical characteristics which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installation; and as herein specified and shown on drawings.

PART 3 - EXECUTION

3.1 SCHEDULING

A. The contractor shall notify the Power Company at least seven days prior to beginning of service entrance construction. Notification shall be in writing with a brief construction schedule included. Provide the name and telephone number of contact person

(installation supervisor). Subsequent to notification, a preconstruction meeting will be held on site. Representatives of the General Contractor and appropriate sub-contractors are required to attend. A Power Company construction and/or metering department representative will review the proposed construction schedule and discuss any construction practices and/or methods applicable to the project. Notify the Architect if there are any discrepancies between the scope in these documents and the meeting with the Power Company. No work shall commence until construction schedule and installation drawings are approved as required by the Power Company.

3.2 EXAMINATION

A. Examine areas and conditions under which service entrance equipment and components are to be installed, and notify Architect in writing of condition detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to Engineer.

3.3 RESPONSIBILITIES

A. The Power Company will provide the following:

1. Primary conduits.
2. Primary conductors and terminations.
3. Primary excavation/backfill/compaction.
4. Primary grounding.
5. Service pad-mounted transformer.
6. Overhead poles.
7. Current Transformers (CT's) on the secondary terminals of the padmount transformer.
8. Secondary meter, furnished and installed.
9. Metering conduit and conductors.
10. Fault current at secondary terminals of service transformer.

B. The Contractor will provide the following:

1. Transformer pad.
2. Secondary conduits from the Power Company transformer to the service entrance switchgear.
3. Secondary conductors from the Power Company transformer to the service entrance switchgear.
4. Secondary excavation/backfill/compaction from the Power Company transformer to the service entrance switchgear.
5. Secondary grounding at service entrance.

3.4 COORDINATION

A. Coordinate the size, layout, and location of concrete equipment pads and/or overhead poles with Power Company.

B. Coordinate quantity and size of incoming service entrance conduits into bottom entrance location of Power Company transformers and service entrance equipment.

C. Installation shall be in strict accordance with the Power Company's requirements and specifications.

D. Coordinate location of pad-mounted transformer:

1. With respect to other entities to maintain a minimum of 10 feet of clearance in the front for operation with a hot stick.
2. With respect to a building's exterior wall to maintain Code and Power Company required working clearances.
3. To allow for a heavy duty vehicle to gain access to the unit for maintenance.

E. Install service entrance equipment in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that service entrance equipment fulfills requirements. Comply with applicable installation requirements of NEC and NEMA standards.

F. Power Company, Architect, and/or Owner shall reserve the right to witness raceway installation prior to being "covered up."

G. Coordinate raceway burial depth, proximity limitations to other utilities, raceway size, raceway quantity, raceway type, elbow type, elbow bending radius, lug wire ranges, and concrete pad dimensions with Power Company.

H. Install units on vibration isolators in accordance with Section 26 05 29 "Hangers and Supports for Electrical Systems" and comply with manufacturer's indicated method of installation.

I. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.

3.5 FIELD QUALITY CONTROL

A. Prior to energization of service entrance equipment, check accessible connections for compliance to manufacturer's torque tightening specifications.

B. Prior to energization of service entrance equipment, check with ground resistance tester, phase-to-phase and phase-to-ground insulation resistance levels to ensure requirements are fulfilled.

C. Prior to energization, check circuitry for electrical continuity, and for short circuits.

3.6 GROUNDING

A. Provide equipment grounding connections for service entrance equipment as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounding.

3.7 ADJUSTING AND CLEANING

A. Adjust operating mechanisms for free mechanical movement.

B. Touch-up scratched or marred enclosure surfaces to match original finishes.

3.8 DEMONSTRATION

A. Upon completion of installation of service entrance equipment and electrical circuitry, energized circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and retest to demonstrate compliance.

3.9 AS-BUILTS

A. The Contractor shall supply two (2) copies of as-built drawings showing the actual location and installation of any underground primary raceways to the Power Company.

END OF SECTION 26 05 95

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes networkable, automatically and manually operated lighting controls with relays, circuit breakers and control module.

B. Refer to LEED requirements related to this Section.

1.3 DEFINITIONS

A. BACnet: A networking communication protocol that complies with ASHRAE 135.

B. BAS: Building automation system.

C. DALI: Digital addressable lighting interface.

D. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.

E. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

F. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

G. PC: Personal computer; sometimes plural as "PCs."

H. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.

I. RS-485: A serial network protocol, similar to RS-232, complying with TIA/EIA-485-A.

1.4 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

1. C62.41-1991 – Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. ASTM International (ASTM) ()

1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

C. Canadian Standards Association (CSA) ().

1. CSA C22.2 # 14 Industrial Control Equipment
2. CSA C22.2 # 184 Solid-State Lighting Controls

D. International Electrotechnical Commission ().

1. (IEC) 801-2 Electrostatic Discharge Testing Standard.
2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches.

E. International Organization for Standardization (ISO)

1. 9001:2000 – Quality Management Systems.

F. National Electrical Manufacturers Association (NEMA)

1. WD1 (R2005) - General Color Requirements for Wiring Devices.

G. Underwriters Laboratories, Inc. (UL) ():

1. 20 (2002) - Standard for Safety for General-Use Snap Switches.
2. 508 (1999) - Standard for Industrial Control Equipment.
3. 924 (2003) - Emergency Lighting and Power Equipment

1.5 SYSTEM DESCRIPTION

A. Lighting Control System

1. Factory assembled switching relay panels and interfaces and modules
2. Low voltage wall stations and control interfaces and sensors.

1.6 SUBMITTALS

A. Product Data: For control modules, power distribution components, conductors and cables, provide catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

B. Specification Conformance Document: Indicate whether the submitted equipment either:

1. Meets specification exactly as stated.
2. Meets specification via an alternate means and indicate the specific methodology used.

C. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.

1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
4. Load schedule of connected load, load type, voltage, circuit numbers, devices, wiring, zoning, and fixtures per area.

D. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.

E. Field quality-control test reports.

F. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

G. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate lighting control components to form an integrated interconnection of compatible components.

1. Match components and interconnections for optimum performance of lighting control functions.
2. Coordinate lighting controls with BAS. Design display graphics showing building areas controlled; include the status of lighting controls in each area.
3. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

B. Coordinate lighting control components specified in this Section with components specified in Division 26 Section "Panelboards."

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of software input/output to execute switching or dimming commands.
b. Failure of modular relays to operate under manual or software commands.
c. Damage of electronic components due to transient voltage surges.

2. Warranty Period: Two years from date of Substantial Completion.
3. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight years.
4. Extended Warranty Period for Electrically Held Relays: 10 years from date of Substantial Completion.

1.10 COMMISSIONING

A. Provide factory-certified field service engineer to make a site visit to ensure proper system installation and operation under following parameters:

1. Qualifications for factory-certified field service engineer:

a. Minimum experience of 2 years training in the electrical/electronic field.
b. Certified by the equipment manufacturer on the system installed.

2. Make a visit upon completion of installation of lighting control system:

a. Verify connection of power feeds and load circuits.
b. Verify connection and location of controls.
c. Energize processor panel and download system data program.
d. Verify proper connection of panel links (low voltage/data) and address panel.
e. Download system panel data to switching panels
f. Check load currents and remove by-pass jumpers.
g. Verify system operation control by control, circuit by circuit.
h. Verify proper operation of manufacturers interfacing equipment.
i. Verify proper operation of manufacturers supplied PC and installed programs.
j. Verify operation of PC modem and test dial-up access.
k. Obtain sign-off on system functions.
l. User to be trained on system operation.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Electrically Held Relays: Equal to ten percent of amount installed, but no fewer than one relay of each type.

1.12 SERVICE AGREEMENT

A. Technical Support: Beginning with Substantial Completion, provide software support for two years.

B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.

1. Provide 30-day notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment, if necessary.

C. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.

D. Make new replacement parts available for minimum of ten years from date of manufacture.

E. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

F. Provide on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

G. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Lutron Softswitch 128 or comparable product by one of the following:

1. Hubbell.
2. Leviton.
3. Lutron.
4. Philips.
5. Wattstopper.

2.2 SYSTEM REQUIREMENTS

A. BAS Interface: Provide hardware and software to enable the BAS to monitor, display, and record data for use in processing reports.

1. ASHRAE 135 (BACnet), Lonworks, RS232, and Contact closure input / Contact closure output communication interface with the BAS shall enable the BAS operator to remotely monitor lighting from a BAS operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the BAS.

2.3 GENERAL

A. Provide hardware that is designed, tested, manufactured, and warranted by a single manufacturer.

B. Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0° C (32°F) to 40° C (104°F) and 90 percent non-condensing relative humidity.

C. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairmentper IEC 801-2.

2.4 PANEL / RELAY PERFORMANCE REQUIREMENTS

A. Electrolytic capacitors to operate at least 20° C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40° C (104° F) ambient temperature.

B. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer/relay.

C. Design and test relays to withstand line-side surges without impairment to performance.

1. Panels: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41B.

D. Utilize air gap off, activated when user selects “off” at any control to disconnect the load from line supply.

E. Possess power failure memory such that if power is interrupted and subsequently returned, lights will automatically return to same levels (on or off) prior to power interruption within 3 seconds.

F. Non-dim circuits to meet the following requirements:

1. Rated life of relay: Minimum 1,000,000 cycles.
2. Load switched in manner that prevents arcing at mechanical contacts when power is applied to load circuits.
3. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

2.5 POWER COMPONENTS

A. Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.

1. Cabinet: Steel with hinged, locking door.

a. Barriers separate low-voltage and line-voltage components.
b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.

a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
c. Endurance: 1,000,000 cycles at rated capacity.
d. Mounting: Provision for easy removal and installation in relay cabinet.

B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

2.6 LCD Processor

A. System to be password protected.

B. Language selection: English.

C. Integral contact closure inputs.

D. Programming and system operation:

1. Control stations, control interfaces, and contact closure inputs
   a. Assign functionality of each control station button or infrared interface.
      1. Select patterns
      2. Select customized pattern
      3. Enable/Disable time clock
      4. Initiate delay to off
      5. Toggle one, some, or all zones
   b. RS232 interface or Ethernet interface
   c. Contact closure output: Momentary or maintained

2. Time clock
   a. Integral astronomical time clock
      1. Geographic location (city or latitude/longitude).
      2. Adjustable date and time format.
      3. Adjustable starting and ending of daylight savings time.
      4. Review and modify time clock schedule to add , copy, modify, and delete events.

3. Overrides:
   a. Set circuit status
   b. Select pattern
   c. Time clock override
   d. Control station overrides
   e. After-hours override

2.7 DIAGNOSTICS AND SERVICE:

A. Replacing relay does not require re-programming of system or processor.

B. Relays: Include diagnostic LED’s to verify proper operation and assist in system troubleshooting.

C. Relay panels: Include tiered control scheme for dealing with component failure that minimizes loss of control for occupant.

1. If lighting control system fails, lights to remain at current level. Panel processor provides local control of lights until system is repaired.
2. If panel processor fails, lights to remain at current level. Circuit breakers can be used to turn lights off or to full light output, allowing non-dim control of lights until panel processor is repaired.

3. If relay fails, factory-installed mechanical bypass jumpers to allow each relay to be mechanically bypassed. Mechanical bypass device to allow for switching operation of connected load with relay removed by means of circuit breaker.

2.8 LOW VOLTAGE CONTROL INTERFACES

A. Contact Closure Interfaces:

1. Where contact closures are used to integrate between lighting controls and other systems:
   a. Input open circuit voltage not to exceed 36V.
   b. Input short circuit current not to exceed 0.5 mA.
   c. Mechanical contact closures to be dry contact rated.
   d. Solid state contact closures:
      1. Output off-state leakage current not to exceed 50mA.
      2. Output on-state saturation voltage not to be less than 2V.
   e. The contact closure input device will accept both momentary and maintained contact closures.

B. RS232 Interfaces:

1. Provide ability to communicate by means of RS232 serial communication Softswitch 128 system by means of user-supplied PC or digital audiovisual equipment. Control to be located within 50 feet (15 meters) of RS232 source.

2. Provide access to:
   a. Pattern selections.
   b. Control individual zones.
   c. Enable/disable time clock.
   d. Setting of time clock.
   e. Enable/disable wall station.
   f. Simulate wall station button press.
   g. Reading/setting of system variables.

3. Provide status monitoring through button feedback and pattern-status updates.

C. Ethernet Interfaces:

1. Provide ability to communicate by means of TCP/IP over Ethernet to Softswitch128 system by means of user-supplied PC or digital audiovisual equipment. Control to be located within 300 feet (100 meters) of Ethernet source.
2. Provide access to:
   a. Pattern selections.
   b. Control individual zones.
   c. Enable/disable time clock.
   d. Setting of time clock.
   e. Enable/disable wall station.
   f. Simulate wall station button press.
   g. Reading/setting of system variables.

3. Provide status monitoring through button feedback and pattern-status updates.

D. BACnet Interface:

1. Provide ability to communicate by means of BACnet IP or BACnet Ethernet communication to centralized lighting system from user-supplied 10BaseT Ethernet network.

2. Provide PIC list definition and object model to other system manufacturers.

E. LonWorks Interface:

1. Provide ability to communicate by means of LonWorks FTT-10 communication to centralized lighting system from user-supplied LonWorks FTT-10 twisted pair network.

2. Provide LonWorks interface object model specification to secondary equipment manufacturers.

2.9 OCCUPANCY SENSORS

A. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay for lighting control and also for interfacing with the BAS system, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Lighting Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:

   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.

5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on function in case of sensor failure.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lx); keep lighting off when selected lighting level is present.

B. PIR Type: Ceiling mounting; detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

C. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. (56 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. (186 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling in a corridor not wider than 14 feet (4.3 m).

D. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

1. Sensitivity Adjustment: Separate for each sensing technology.
2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.10 CONDUCTORS AND CABLES

A. Power Wiring: Not smaller than No. 12 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cables: Multi-conductor “control” cable with copper conductors not smaller than No. 22 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multi-conductor “sensing” cable with copper conductors not smaller than No. 18 AWG, complying with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install wiring in raceways. Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" Minimum conduit size shall be 3/4 inch.

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

D. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.

E. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

F. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.

G. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Test for circuit continuity.
2. Verify that the control module features are operational.
3. Check operation of local override controls.
4. Test system diagnostics by simulating improper operation of several components selected by Architect.

3.3 SOFTWARE INSTALLATION

A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

3.4 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors and to assist Owner's personnel in making program changes to suit actual occupied conditions. Provide up to two visits to Project during other than normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, program, and maintain lighting controls. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 260923

SECTION 26 22 00 – DRY TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following types of dry-type transformers rated 600 V and less, with capacities up to 1000 kVA:

1. Distribution transformers.

B. Related Sections include the following:

1. Section 26 05 53 "Identification for Electrical Systems" for identification requirements.
2. Section 26 05 29 “Hangers & Supports for Electrical Systems” for supporting requirements.
3. Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding requirements.
4. Section 26 05 00 “Common Work Results for Electrical” for concrete pads.
5. Section 26 24 16 “Panelboards” for transformers integrated into a power center assembly.

1.3 SUBMITTALS

A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, impedance, construction type, drawing designation, and performance for each type and size of transformer indicated.

B. Shop Drawings: Wiring and connection diagrams.

C. Manufacturer Seismic Qualification Certification: Submit certification that transformer assembly and components will withstand seismic forces defined in Section 260529 “Hangers and Supports for Electrical Systems”. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Source quality-control test reports.

E. Output Settings Reports: Record of tap adjustments specified in Part 3.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C 57.12.91.

C. Comply with IEEE C 57.96 regarding overload capability for standards transformers.

D. Energy-Efficient Transformers Rated 15 kVA and Larger: Certified as meeting NEMA TP 1, Class 1 efficiency levels when tested according to NEMA TP 2.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.6 COORDINATION

A. Coordinate installation of wall-mounting and structure-hanging supports with Manufacturer.

B. Coordinate seismic requirements specified in Section 260529 "Hangers and Supports for Electrical Systems".

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cutler-Hammer.
2. Siemens
3. Square D/Groupe Schneider NA (basis of design).

2.2 MATERIALS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Cores: Grain-oriented, non-aging silicon steel.

C. Coils: Continuous windings without splices, except for taps.

1. Internal Coil Connections: Brazed or pressure type.
2. Coil Material: Aluminum.

D. Lugs: Dual copper/aluminum rated mechanical.

2.3 DISTRIBUTION TRANSFORMERS

A. Comply with NEMA ST 20, and list and label as complying with UL 1561.

B. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

C. Provide transformers that are internally braced to withstand seismic forces specified in Section 260529 "Hangers and Supports for Electrical Systems".

D. Cores: One leg per phase.

E. Enclosure: Ventilated, raintight, NEMA 250, Type 3R, for outdoor transformers.

F. Core and coil shall be encapsulated within resin compound, sealing out moisture and air.

G. Indoor Transformer Enclosure Finish: Comply with NEMA 250 for "Indoor Corrosion Protection."

1. Finish Color: Gray.

H. Insulation Class: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.

I. Taps for Transformers Smaller Than 3 kVA: One 5 percent tap above normal full capacity.

J. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.

K. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 COORDINATION

A. Provide required lug sizes and quantities per phase as indicated on the drawings and coordinate with transformer manufacturer.

3.2 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine racks for suitable mounting conditions where transformers will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Install wall-mounting transformers level and plumb with wall brackets fabricated by transformer manufacturer.

1. Brace wall-mounting transformers as specified in Section 260529 "Hangers and Supports for Electrical Systems".

B. Provide flexible conduit connection to both primary and secondary side of transformer, unless roughing in to the bottom from underground or underslab.

3.4 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

D. Install ground conductor back to main service grounding electrode.

3.5 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 10 percent and not being lower than nameplate voltage minus 5 percent. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

END OF SECTION 26 22 00

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Lighting and appliance branch-circuit panelboards.

B. Related Sections include the following:

1. Section 26 05 26 "Grounding and Bonding for Electrical Systems" for additional grounding specification items.
2. Section 26 22 00 “Dry Type Transformers” for panels integrated into a power center assembly.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. LIM: Line Isolation Monitor.

D. RFI: Radio-frequency interference.

E. RMS: Root mean square.

F. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of panelboard indicate the accessories and components as noted on drawings or these specifications and place in alphabetical order of the designation name. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. The layout of overcurrent protection devices shall be in accordance with the schedules shown on the drawings, in lieu of manufacturer's standard layouts.

2. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

    a. Enclosure and cover types, mounting types, and details.
    b. Grounding bars.
    c. Nametags (not standard manufacturer's type).
    d. Panelboard layout diagrams.
    e. Bus configurations, bus material, current, voltage, phase, wire ratings.
    f. Short-circuit current full rating of panelboards and overcurrent protective devices.
    g. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

3. Wiring Diagrams: Power, signal, and control wiring.

C. Manufacturer Seismic Qualification Certification: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260529 "Hangers and Supports for Electrical Systems". Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

    a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

E. Panelboard Schedules: For installation in panelboards.

F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 26 05 00 "Common Work Results for Electrical," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories through one source from a single manufacturer.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of panelboards and are based on the specific system indicated. Refer to Section 016000 "Product Requirements."

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet (2000 m).

1.7 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 260500 “Common Work Results for Electrical.”

C. Coordinate erection of recessed panelboards with wall erection. Coordinate erection of wall mounted panelboards with priming and painting of walls.

1.8 ELECTRICAL IDENTIFICATION

A. Refer to Section 26 05 53 “Identification for Electrical Systems” and the drawing details for non-standardized nametag information.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton Corporation; Cutler-Hammer Products.
b. Siemens Energy & Automation, Inc.
c. Square D (basis of design).

2.2 MANUFACTURED UNITS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260529 “Hangers and Supports for Electrical Systems”.

B. Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 1.

1. Rated for environmental conditions at installed location.

a. Outdoor Locations: NEMA 250, Type 3R.

2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
4. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.
5. Directory Card: Typewritten or computer generated card with transparent protective cover, mounted in metal frame or plastic frame, inside panelboard door.

C. Phase and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Equipment Ground Bus: Adequate capacity and size to accommodate all feeder and branch-circuit equipment ground conductors; bonded to box.

D. Conductor Connectors: Suitable for use with conductor material.

1. Main and Neutral Lugs: Mechanical type.
2. Ground Lugs and Bus Configured Terminators: Mechanical type.
3. Feed-Through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
4. Sub-Feed Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

E. Service Equipment Label: UL labeled for use as service equipment for panelboards, when utilized as such.

F. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

2.3 PANELBOARD SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.4 DISTRIBUTION PANELBOARDS

A. Doors: Dead-front, secured with vault-type latch with tumbler lock; keyed alike.

B. Main Overcurrent Protective Devices: Thermal-magnetic, molded-case, bolt-on circuit breaker.

C. Branch Overcurrent Protective Devices:

1. For Circuit-Breakers: Thermal-magnetic, molded-case, bolt-on circuit breakers.

2.5 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Thermal-magnetic, molded-case, bolt-on circuit breakers, replaceable without disturbing adjacent units. Branch circuit breakers shall be rated at 80%, unless otherwise noted.

B. Doors: Hinged door within hinged door; secured with screw fasteners and with flush latch and tumbler lock; keyed alike.

2.6 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity. Provide GFCI circuit breakers for all of the following whether or not

indicated on the drawings: electric water coolers, heat trace, ice machines, and receptacles near water sources such as sinks.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment loads. Confirm breaker listings with circuiting.
3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator. Provide as indicated on the drawings.
4. Multipole units enclosed in a single housing or factory-assembled to operate as a single unit.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Furnish accessory set including tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Section 260529 “Hangers and Supports for Electrical Systems”.

C. Mount top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.

D. Mount plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Install overcurrent protective devices and controllers.

1. Set field-adjustable switches and circuit-breaker trip ranges under direction of Engineer.

F. Install filler plates in unused spaces.

G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

H. Surface mounted panelboards can be installed on stand off strut as long as all clearances are maintained.

I. All spare circuit breakers shall be left in the OFF position.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads. Schedule a meeting with the Owner and obtain Owner's final room naming and numbering scheme prior to creating directory, which may or may not match the contract drawings. Provide brief description of each circuit load and room number(s) being served and indicate on the directory. Use a computer or typewriter to create directory; handwritten directories are not acceptable. Revise existing panelboard schedules, as required, for a renovation project.

C. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3.3 CONNECTIONS

A. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard supplying and exiting feeder.
2. Test continuity of each circuit.

B. Perform the following field tests and inspections and prepare test reports:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading as best as possible.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 15 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
5. Revise panelboard directories according to any shifting of circuits.

3.5 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Simplex and duplex receptacles.
2. Ground-fault circuit interrupter receptacles.

B. Related Sections include the following:

1. Section 26 05 53 "Identification for Electrical Systems" for special device colors and nametag identification on device plates.
2. Section 26 05 26 "Grounding and Bonding for Electrical Systems" for grounding connections to wiring devices.
3. Section 26 56 68 “Exterior Athletic Lighting” for receptacles mounted in pole bases.

1.3 DEFINITIONS

A. AFCI: Arc-fault circuit-interrupter.

B. EMI: Electromagnetic interference.

C. GFCI or GFI: Ground-fault circuit interrupter.

D. IG: Isolated Ground.

E. LED: Light-emitting diode.

F. PVC: Polyvinyl chloride.

G. RFI: Radio-frequency interference.

H. TVSS: Transient voltage surge suppressor.

I. UTP: Unshielded twisted pair.

J. Wall-Box Dimmer: A self-contained dimmer that fits into a switch box.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified, if requested.

D. Field quality-control test reports.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by an “approved” third-party testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:

a. Hubbell Incorporated; Wiring Device-Kellems.
b. Leviton Mfg. Company Inc.
c. Pass & Seymour/Legrand; Wiring Devices Div.

2.2 RECEPTACLES

A. All receptacles shall be listed by an “approved” third-party agency, approved for the voltage and amperage indicated.

B. Straight-Blade-Type Receptacles, General: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, UL 498, and NEMA WDI 101968. Arrange for side wiring only.

C. Straight-Blade and Locking Receptacles, Specific: Heavy-Duty specification grade only (i.e. Hubbell #HBL5362). Receptacles marked as commercial grade, construction grade, commercial/specification grade, or specification grade (i.e. Hubbell #CR20) are not acceptable.

D. Straight-Blade Receptacles: Heavy-Duty hospital grade, tamper resistant safety type (i.e. Hubbell #HBL8300).

E. Grounding Type Receptacles: All receptacles shall be of the grounding type with a dedicated green grounding screw for terminating the equipment grounding conductor.

F. Rating: All receptacles are to be rated at 20 amps, unless otherwise noted.

G. GFCI Receptacles: Straight blade, non-feed-through type, Heavy-Duty duplex receptacle specification grade (i.e. Hubbell #GF20), with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-1/8-inch deep outlet box without an adapter.

2.3 WALL PLATES

A. Single and combination types of standard sizes to match corresponding wiring devices. The use of jumbo plates is strictly prohibited unless otherwise directed.

1. Plate-Securing Screws: Metal with slotted oval head; color to match plate finish.
2. Material for Surface Mounted Devices in Unfinished Spaces: Galvanized steel raised surface.
3. Material for Wet Location Receptacles: Thermoplastic with spring-loaded lift cover, and listed and labeled by an “approved” third-party for “wet while in use".
4. Material for Wet Location Switches: Clear rubber silicon bubble elastomer plate, and listed and labeled by an “approved” third-party for “wet while in use".

2.4 EXECUTION

2.3 INSTALLATION

A. Install wiring devices and coverplates level, plumb, and square with building lines.

B. Flush mounted devices and coverplates shall be installed so that the device sticks out a minimum of 1/16” from the device plate.

C. Devices shall be mounted securely to outlet box and coverplate so that it does not move when being plugged into.

D. Install unshared dedicated neutral conductors on line and load side of GFCI receptacles.

E. Arrangement of Devices: Unless otherwise indicated or physically impossible, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. If wall space does not permit a vertical installation, such as above a counter and/or backsplash, then mount flush, with long dimension horizontal, and with neutral terminal of receptacles on top.

F. Provide black electrical tape around wiring devices/terminals.

2.4 CONNECTIONS

A. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

2.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.
2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in disconnect switches.

1.3 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

B. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 260500 "Common Work Results for Electrical," include the following:

a. Let-through current curves for fuses with current-limiting characteristics.
b. Time-current curves, coordination charts and tables, and related data.
c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussman, Inc.
2. Eagle Electric Mfg. Co., Inc.; Cooper Industries, Inc.
3. Ferraz Shawmut, Inc.
4. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1 or UL listed, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Other Equipment or Branch Circuits Where Fault Current is Less Than 50,000 Amps: Class RK1, UL listed, dual element time delay with 200,000 Amps interrupting rating.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Coordinate fuse sizes with installed equipment nameplate as to provide a fully selective system.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 26 28 13

SECTION 26 28 16 - DISCONNECT SWITCHES AND ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Non-fusible switches.
3. Enclosures.

B. Related Sections include the following:

1. Section 26 05 53 "Identification for Electrical Systems" for device labeling.
2. Section 26 28 13 "Fuses" for fuses to be installed in disconnect switches.

1.3 DEFINITIONS

A. GD: General duty.

B. GFCI: Ground-fault circuit interrupter.

C. HD: Heavy duty.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

F. DPDT: Double pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and equipment being protected for each (i.e. motor designation) and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

Shop drawings that do not specifically identify the equipment being protected by each disconnect by designation cannot be reviewed by the engineer and will be rejected.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 26 05 00 "Common Work Results for Electrical," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
2. Time-current curves, including selectable ranges for each type of circuit breaker.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a third party testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70, including non-interchangeability of different types of fuses within fuse holders of disconnect switches.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions, unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.7 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton Corporation; Cutler-Hammer Products.
2. Siemens Energy & Automation, Inc.
3. Square-D/Group Schneider (basis of design).

B. Fusible Switch, 1200 A and Smaller:

1. NEMA KS 1, Heavy Duty Type, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
2. General Duty Type shall not be permitted.
3. The door interlocks that prevent the door from opening when the operating handle is in the “on” position shall be defeatable.
4. Switches shall have handles whose positions are easily recognizable in the “on” position or “off” position.
5. For safety reasons, identical keyed padlocks shall be provided for switches located in public areas. Coordinate these padlocks with the Owner.
6. Switches shall have non-fusible, positive, quick-make quick-break mechanisms.
7. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
8. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors; only required when a neutral conductor is to be terminated. Coordinate with circuiting.
9. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open; only when specified elsewhere.
10. Provide fuse rejection kits for all switches containing rejection type fuses.

C. Non-fusible Switch, 1200 A and Smaller:

1. NEMA KS 1, Heavy Duty Type, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
2. General Duty Type shall not be permitted.
3. The door interlocks that prevent the door from opening when the operating handle is in the “on” position shall be defeatable.
4. Switches shall have handles whose positions are easily recognizable in the “on” position or “off” position.
5. For safety reasons, identical keyed padlocks shall be provided for switches located in public areas. Coordinate these padlocks with the Owner.
6. Switches shall have non-fusible, positive, quick-make quick-break mechanisms.
7. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
8. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors; only required when a neutral conductor is to be terminated. Coordinate with circuiting.
9. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open; only when specified elsewhere.

2.3 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 3R, UON.
2. Other Wet or Damp Indoor Locations: NEMA 250, Type 3R, UON.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Comply with mounting and anchoring requirements specified in Section 260529 "Hangers and Supports for Electrical Systems”.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Coordinate location, size, voltage, phase, auxiliary contacts, control power, and control wiring requirements with respective equipment Contractor.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 05 53 "Identification for Electrical Systems."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Section 26 05 53 "Identification for Electrical Systems."

C. FIELD QUALITY CONTROL

D. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

E. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

F. Perform the following field tests and inspections and prepare test reports:

1. Test mounting and anchorage devices according to requirements in Section 260529 "Hangers and Supports for Electrical Systems.
2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.4 ADJUSTING

A. Set field-adjustable switches, circuit-breaker trip ranges, and fused disconnect switches fuse ratings according to equipment nameplate data and Engineer’s direction.

3.5 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16

SECTION 26 43 13 – SURGE PROTECTION DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes parallel connected SPDs for low-voltage power, control, and communication equipment. SPD units shall consist of MOV technology and not SAD technology.

B. Related Sections include the following:

1. Section 26 27 26 "Wiring Devices" for devices.

2. Section 26 24 16 “Panelboards” for devices connected to panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance Testing Specifications.

B. MOV: Metal Oxide Varistor.

C. SAD: Silicon Avalanche Diode.

D. SSCR: Single (impulse) Surge Current Rating.

E. SPD: Surge Protection Device.

F. VPR: Voltage Protection Rating.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, accessories, clamping voltages per mode, SSCR ratings, maximum surge current per mode, and equipment name (i.e. panelboard designation) being protected for each. Ratings shall be produced from a third party independent testing laboratory. Ratings/testing shall include any and all fusing whether field or factory installed.

B. Drawings: Electrical and mechanical drawings shall be provided by the manufacturer which show unit dimensions, weights, mounting provisions, connection notes, wire size and wiring diagram.

C. Product Certificates: For surge protection devices, signed by product manufacturer certifying compliance with the following standards:

1. UL 1449, Edition 4, as a stand-alone device.

D. Independent Testing:
1. High exposure with the 10 x 1,000μs tests per IEEE C62.41.2 Section 7.2
2. Life Cycle/Repetitive Testing per C62.45-2002 section B.38 minimum of 1,000 to 2,000 times
3. Additional testing may be required for per phase or per mode fused products with a 200kA or 100kA per phase per IEEE C62. Products must be on line and function after surge test.

E. National Electrical Code (NEC) 285 - Installation requirements for SPD.
1. Section 285.2, SPD must limit transient voltage by diverting or limiting surge current; it also should prevent continued flow of follow current while remaining capable of repeating these functions. SPD that utilize fuses must have repetitive surge capability that can survive its surge rating and meet UL 1449.
2. Section 285.6, SPD shall be marked with a short circuit current rating and shall not be installed at a point on the system (ex. service, distribution or branch panels) where the available fault current (AIC rating) is in excess of that rating.

F. UL 1449, Edition 4 stipulation for fused SPD - The manufacturer's authorized representative is required to submit the following:
1. Certify that the SPD system is UL 1449 listed (UL Card) with UL Card.
2. Indicate the type of internal or external fusing that is incorporated in the SPD system and what impact the fusing has on the performance of the device with respect to surge capacity and clamping levels.

G. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals. The manufacturer shall furnish an installation manual with installation notes, start-up and operating instructions for the specified system. Installation instructions shall clearly state whether the system requires an external overcurrent device to maintain the system's UL 1449 listing.

H. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Underwriters laboratories 1449 - (UL 1449 3rd edition, 2009, as a stand alone device)
Underwriters laboratories 1283 - (UL 1283 listed as an electromagnetic interference filter hat provides noise attenuation)
Underwriters laboratories 67 - (UL 67 internal integration of SPD in panelboard)

E. National electrical code 2005 rev. - (NEC article 285 SPD installation practice/NEC article 250.56 grounding)
NFPA-78 and CSA - (National Fire Protection Association and Canadian Standards Associations)
ISO 9001:2000 - quality standard / military standards (mil-std 220a)

F. IEEE (INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERING INC.) C62.41.1 AND C62.41.2 – 2002 REV. - (SYSTEM SHALL BE DESIGNED TO MEET C62.41)
1. IEEE C62.41.2-2002 section 7.2 long duration 10 x 1,000 μsec test to be compliant if the device exhibits less than 10% deviation from initial readings. Units must be tested to withstand and pass the 10 x 1,000 μsec test
2. IEEE C62.45 – 2002 rev. - (system shall be tested to meet the C62.45)
3. Category A & B - (0.5 μs x 100 kHz ring wave)
4. Category B3 bi-wave - (8 x 20 μs at 3,000 amperes and 1.2 x 50 μs at 6,000 volts)
5. Category C3 bi-wave - (8 x 20 μs at 10,000 amperes and 1.2 x 50 μs at 20,000 volts)

G. The fusing elements must be capable of allowing the suppressor's rated single impulse current to pass through the suppressor at least one time without failure. The system shall be tested to 1,000 sequential per C62.45-2002 section B.38 referencing C62.41.1 and C62.41.2 category C3 combination wave transients. The category C3 combination wave is defined as a 1.2 x 50 microsecond wave at 20,000 volt open circuit voltage waveform and 8 x 20 microsecond wave at 10,000 ampere short circuit current waveform. In addition, the system components shall be tested repetitively 1,000 times testing based on an IEEE C62.33 (MOV test) and C62.35 (SAD test) without failure or degradation exceeding ±10%.

H. CBEMA (ITIC) and IEC - (Computer Business Equipment Manufacturers Association or Information Technology Industry Council and International Electrotechnical Commission define clamping voltage tolerance guidelines for sensitive equipment).

I. All manufacturers must comply with above listed standards and any additions current revisions of industry standards. All products that do not comply with current industry standards will not be accepted.

1.6 PROJECT CONDITIONS

A. Each protection device shall have a capacitive filtering system connected in each Line to Neutral (L→N) (Wye) mode or Line to Line (L→L) (Delta) mode to provide EMI/RFI noise attenuation (UL 1283).

B. Protection modes: The SPD shall provide Line to Neutral (L→N) (Wye), Line to Ground (L→G) (Wye or Delta), Line to Line (L→L)(Delta) and Neutral to Ground (N→G)(Wye) protection.

C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

D. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:

1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
2. Operating Temperature: 30 to 120 deg F (0 to 50 deg C).
3. Humidity: 0 to 85 percent, noncondensing.
4. Altitude: Less than 20,000 feet (6090 m) above sea level.

1.7 COORDINATION

A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

B. Coordinate SCCR (short circuit current ratings) of SPD device to meet or exceed the same rating of the associated device (panelboard) being protected.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under the other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within ten (10) years from date of Substantial Completion. Note that is a material warranty and does not include labor.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. APT.
2. Current Technology, Inc.
3. LEA International.
4. Liebert Corporation; a division of Emerson.
5. Surge Suppression Inc. (Basis of Design).

2.2 SERVICE ENTRANCE SUPPRESSORS

A. Surge Protection Device Description: With the following features and accessories:

1. Type 2.
2. Branch circuit breaker protection.
3. Redundant suppression circuits.
4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
5. Front panel and internal audible alarm (with silencing switch) and LED (red/green) indicator lights to indicate that the unit has taken a surge and has fallen below a certain level of protection indicating the need for replacement.
6. One set of “form C” dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status. Coordinate with Building Automation System.
7. Digital surge-event operations counter.
8. Component level fusing at each MOV in lieu of up front current limiting fuses. The system protection modules shall contain a technology that utilizes a symmetrical array of balanced metal oxide varistors (MOV). Each MOV will be individually coordinated to pass UL 1449.
9. Equipment shall be a multi-stage parallel protector rated for a certain voltage and minimum peak surge current capability per phase as noted on the one-line/riser diagram and the panelboard schedules.
10. All primary transient paths shall utilize copper wire, aluminum bus bar and lugs of equivalent capacity to provide equal impedance interconnection between phases. No plug-in module or components shall be used in surge carrying paths.
11. Each protection module shall have a visual indicator that signifies that the protection circuitry is on line. The unit shall not be taken off line to verify integrity of system. Redundant status indicators shall be mounted on the front of the door that monitors the system protection circuitry.
12. The system shall be modular with field replaceable modules. Modular units shall contain a minimum of one module per phase.

B. Peak Single-Impulse Surge Current Rating: As noted on drawings.

C. Connection Means: Permanently wired.

D. Provide ten (10) modes of protection.

E. Provide VPR to meet UL 1449, 3rd edition for specified voltage.

F. Refer to drawings for Voltage and Phase per device.

2.3 ENCLOSURES

A. NEMA 4X (outdoor) or NEMA 12 (indoor) type matching the enclosure of the adjacent panel or device being protected.

PART 3 - EXECUTION

3.1 INSTALLATION OF SURGE PROTECTION DEVICES

A. Install devices at service entrance on load side of main breaker, with ground lead bonded to service entrance ground. Install devices immediately adjacent and external to the panelboard being served.

B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

C. The specified service entrance/switchboard/switchgear system shall be installed with the shortest lead length possible not to exceed five (5') electrical feet from the power conductor(s) it is protecting, must have a grounding of 25 Ohms (NEC Article 250.56) or less and shall avoid any unnecessary or sharp bends. Utilize a 3 pole branch breaker for connection means. See manufacturers' installation manual.

D. The specified distribution and branch panelboard system shall be installed with the shortest lead length possible not to exceed a foot and half (1.5') electrical feet from the power conductor(s) it is protecting, must have a grounding of 25 Ohms (NEC Article 250.56) or less and shall avoid any unnecessary or sharp bends. Utilize a 3 pole branch breaker for connection means. See manufacturers' installation manual.

1. When a multi-pole, circuit breaker is provided as a dedicated disconnect for suppressor, coordinate the size of this breaker between the SPD supplier and the switchgear supplier, as opposed to the circuit breaker rating listed on the drawings. The circuit breaker listed on the drawings for based on one manufacturer which may very from one to the next.

3.2 PLACING SYSTEM INTO SERVICE

A. Do not energize or connect service entrance equipment to their sources until surge protection devices are installed and connected.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation, including connections, and to assist in field testing. Report results in writing.

1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. Testing: Perform the following field tests and inspections and prepare test reports:

1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
2. Complete startup checks according to manufacturer's written instructions.
3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.19, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

C. Remove and replace malfunctioning units and retest as specified above.

D. Relocate/reinstall devices as required per manufacturer’s on-site recommendations to secure the specified warranty.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Section 26 01 00 "Basic Electrical Requirements."

END OF SECTION 26 43 13

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections include the following:

1. Section 262726 "Wiring Devices" for manual wall-box dimmers.
2. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, LCP’s and multipole lighting relays and contactors.
3. Section 260529 "Hangers and Supports for Electrical Systems" for seismic supporting criteria.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index.

C. CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Luminaire: Complete lighting fixture, including ballast housing if provided.

G. RCR: Room cavity ratio.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions, material type for housing/ door frame/trim/lens/reflector/etc., mounting information, and efficacy and illuminance-efficiency data.
2. Emergency lighting units and battery packs including battery and charger information. Exit sign fixtures shall quantify the light uniformity across the face of the sign according to requirements in Part 2 below.
3. Ballast type, input voltage(s), sound transmission type, temperature operating limits, ballast factor, line current amperes, and power factor. Ballast cut sheet shall be separate from ballast manufacturer and not listed as an option or type on the fixture cut sheet.
4. Lamp type, life in hours, temperature in Kelvin, output in watts, Color Rendering Index, TLCP compliance, coated or clear, lamp pin/socket configuration, lamp orientation, and initial and mean lumen output for lamps. Lamp cut sheet shall be separate from lamp manufacturer and not listed as an option or type on the fixture cut sheet.
5. Provide manufacturer's point by point illumination study for each of the areas listed below, both on normal power and emergency power:

    a. Gymnasium.

6. Point by point calculations to include the following:

    a. Point-by-point calculations of horizontal and vertical illuminance, at close grid size for viewing within the project area.
    b. Total electrical load, in kilowatts, of lighting system.
    c. LLF, LLD used in calculations.
    d. Summary table showing AVG, MAX, MIN, MAX/MIN, AVG/MIN, COEF VAR, UNIF GRAD.
    e. Location of fixtures with types.

7. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

    a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.
    b. Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program (NVLAP) for Energy Efficient Lighting Products.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

1. Wiring Diagrams: Power and control wiring.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, signed by product manufacturer.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

F. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Emergency fixtures shall comply with UL 924, NEC Article 700, NFPA 5000, NFPA 1, NFPA 101, and Energy Star.

D. All fixtures shall be UL listed and have UL labeling on the fixtures according to the type of useage.

E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

F. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections, where indicated in the construction documents by Architect or Engineer.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and required associated trims, plaster frames and suspension/mounting systems with the adjacent mounting surface that is supported by them.

B. Coordinate voltage of fixtures with floor plan circuiting, if not indicated on the light fixture schedule itself.

C. Coordinate the need for IC rated fixtures in IC rated ceilings with direct insulation contact.

D. Coordinate the need for tenting of fixtures or provision of fire rated enclosures (such as the product manufactured by E.Z. Barrier for recessed downlights) in fire rated ceilings.

1.7 WARRANTY

A. Special Warranty for LED Fixtures: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within five (5) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified either in these specifications or on the lighting fixture schedule on the drawings.
2. Substitutions: Refer to Division 260100 “Basic Electrical Requirements” concerning substitutions.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. Manufacturers: Refer to the lighting fixture schedule on the drawings.

B. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

C. LED Fixtures: Comply with ANSI C78-377, IESNA LM-79/80.

D. Metal Parts: Free of burrs and sharp corners and edges.

E. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

G. Over Food Prep and Serving Areas: Provide lens.

H. Plastic Diffusers, Covers, and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

   a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
   b. UV stabilized.

2. Glass: Annealed crystal glass, unless otherwise indicated.

I. Ballast Disconnect Plugs: Provide factory wired disconnect plugs per fixture as required to meet the NEC.

2.3 EXIT SIGNS

A. Manufacturers: Refer to the lighting fixture schedule on the drawings.

B. Description: Comply with UL 924 and NFPA 101 and NEMA; for sign colors, visibility, and luminance, comply with authorities having jurisdiction. Letters shall be 6" high with a ¾" brush stroke. Chevrons shall be viewable at 40 feet. Fixture shall maintain 30 candela/meter-squared for light uniformity across the face of the exit sign. Maximum wattage of either single or double face sign is to be 5 watts.

C. Internally Lighted Signs:
   1. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life. 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.
   2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
      a. Battery: Sealed, maintenance-free, nickel cadmium type as noted on drawings with 12 volt output and minimum 10-year nominal life and special warranty. Batteries shall be a high temperature type with an operating range of 0 degrees C to 60 degrees C and contain a resealable pressure vent, a sintered + positive terminal and – negative terminal. Batteries shall provide a minimum of 90 minute operating endurance.
      b. Charger: Fully automatic, solid-state type, full wave rectifying, current limiting with sealed transfer relay. Charger shall restore the battery to its full charge within 24 hours after a discharge of 90 minutes under full rated load. A low voltage disconnect switch shall be included.
      c. Operation: Relay automatically energizes lamps from battery when circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger. Transfer time shall be less than 10 seconds.
      d. Wire Guard: Where indicated on drawings and in gymnasiums, provide heavy-chrome-plated wire guard to protect fixture.
      e. Options: Provide pilot light to indicate the unit is connected to AC power. The battery shall have high rate charge pilot light, unless self-diagnostic

type. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle. A test switch to simulate the operation of the unit upon loss of AC power by energizing the lamps from the battery. This simulation must also exercise the transfer relay.

f. Voltages: Where dual voltage 120/277 volt battery packs are available, provide batteries of this type.

g. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

h. Integral Self-Diagnostics Test: Factory-installed electronic device automatically initiates code-required tests of unit emergency operation at required intervals along with self diagnostics. Test failure is annunciated by an integral audible alarm and flashing red LED.

3. Master/Remote Sign Configurations:

a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in adjacent LED exit sign power supply for power connection to remote unit.

b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

2.4 EMERGENCY LIGHTING UNITS

A. Manufacturers: Refer to the lighting fixture schedule on the drawings.

B. Description: Self-contained units complying with UL 924 and NFPA 101 and NEMA.

1. Battery: Sealed, maintenance-free, nickel cadmium type as noted on drawings with 12 volt output and minimum 10-year nominal life and special warranty. Batteries shall be a high temperature type with an operating range of 0 degrees C to 60 degrees C and contain a resealable pressure vent, a sintered + positive terminal and – negative terminal. Batteries shall provide a minimum of 90 minute operating endurance.

2. Charger: Fully automatic, solid-state type, full wave rectifying, current limiting with sealed transfer relay. Charger shall restore the battery to its full charge within 24 hours after a discharge of 90 minutes under full rated load. A low voltage disconnect switch shall be included.

3. Operation: Relay automatically turns dual lamps on when power supply circuit voltage drops to 80 percent of nominal voltage or below. Lamps automatically disconnect from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger. Transfer time shall be less than 10 seconds.

4. Wire Guard: Where indicated and in gymnasiums, provide heavy-chrome-plated wire guard protects lamp heads or fixtures.

5. Options: Provide pilot light to indicate the unit is connected to AC power. The battery shall have high rate charge pilot light, unless self-diagnostic type. A test switch to simulate the operation of the unit upon loss of AC power by energizing the lamps from the battery. This simulation must also exercise the transfer relay.
6. Power Factor shall be greater than 0.7.
7. Integral Time-Delay Relay: Holds unit on for fixed interval of 10 minutes when power is restored after an outage. Provide where indicated on drawings.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Diagnostics Test: Factory-installed electronic device automatically initiates code-required self test of unit emergency operation at required intervals along with self diagnostics. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.5 EMERGENCY LED POWER UNIT

A. Manufacturers:

1. Bodine.
2. Emergi-Lite.
3. Iota.
4. Lithonia.
5. Sure-Lites.

B. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with driver, 1400 lumen. Comply with UL 924.

1. Capacity: Must be able to operate for a minimum of 90 minutes at rated lumen output. Battery must be rated at minimum of 24 watt hours.
2. Power Factor shall be greater than 0.9.
3. Test Push Button and Indicator Light: Visible and accessible without entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    c. Location: Flush in adjacent ceiling pad connected to fixture with flexible conduit.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
6. Operation: Transfer time shall be less than 10 seconds.
7. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required self test of unit emergency operation at required intervals along with self diagnostics. Test failure is annunciated by an integral audible alarm and flashing red LED.
9. Outdoor Locations: Unit must be designed and tested to operate from -18 degrees C to +55 degrees C.

C. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more LED fixtures, remote mounted from lighting fixture, 3000 lumens. Comply with UL 924.

1. Capacity: Must be able to operate for a minimum of 90 minutes at rated lumen output. Battery must be rated at minimum of 24 watt hours.
2. Battery: Sealed, maintenance-free, nickel-cadmium type.
3. Charger: Fully automatic, solid-state, constant-current type.
4. Housing: NEMA 250, Type 1 enclosure. Mount remote emergency ballast on top of or near to fixture as possible.
5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
6. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
7. **Distance Limitations:** Use extreme care and coordinate length of wire leads from emergency ballast to fixture with manufacturer to ensure proper operation.
8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.
10. Outdoor Locations: Unit must be designed and tested to operate from -18 degrees C to +55 degrees C.

2.6 EMERGENCY LIGHTING RELAY

A. Manufacturers:

1. 924, Inc.
2. Bodine.
3. Iota.

B. Description: Self-contained power supply and low voltage relay units complying with UL 924, NEC Article 700, NFPA 101 and NEMA.

C. Allows normal switching of designated emergency lighting fixture(s) via dimmers, relays, or local switches while overriding this input and automatically switching the fixture(s) on when the normal power fails.

D. Wall mounted single gang unit with stainless steel device cover, test switch, and LED indicator lights or Unit to be mounted within driver cover channel with remote mounted

test switch and LED indicator lights. Amber LED indicator light for normal utility power availability. Red LED indicator light for unswitched emergency power availability. Green LED indicator light for notification that test switch is activated and emergency power is switched over.

E. Ten amp load rating.

F. Coordinate voltage rating with associated fixture circuiting.

G. Warranty: Full five year material warranty.

2.7 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" & Section 260548 “Vibration and Seismic Controls for Electrical Systems” for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with ceiling canopy. Finish same as fixture. Provide swivel hanger when mounted on sloped ceilings.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gauge (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

H. Safety Chain: Provide safety chain, as suggested by manufacturer, from the fixture up to the structure as a secondary means of supporting all HID pendant mounted fixtures.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Where emergency battery packs are installed within a light fixture, provide a small red painted dot in the surface of the door frame of the fixture in the field to mark its location.

B. Install fixtures per manufacturer’s recommendations and maintain clearance requirements.

C. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

D. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.
1. Install a minimum of four (4) dedicated ceiling support system rods or wires for each 2'x2', 1'x4', 2'x4', or 4'x4' fixture, one at each corner of the fixture independently to the structure, with twists as required. Grid ceiling mounted troffers shall be installed so that they are flush with the ceiling grid after the grid has been leveled. Provide minimal slack in structure supports to allow for final leveling and adjustments of the ceiling. Locate not more than 6 inches (150 mm) from lighting fixture corners. Install a minimum of one dedicated ceiling support system rod or wire for each downlight.
2. Hurricane Support Clips: Provide these as separate fasteners in addition to the factory installed clips on modern rectilinear troffer fixtures. Fasten to lay-in troffer lighting fixtures at or near each fixture corner. Provide clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. E.C. shall provide strut as required underneath elements such as ductwork to independently support their electrical equipment, such as light fixtures. No light fixture support wires shall touch an interfering object (such as ductwork) prior to terminating to the ceiling structure.

E. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

F. Adjust aimable lighting fixtures to provide required light intensities.

G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

H. Coordination: Coordinate lamp/driver, lamp base, lamp orientation, and lamp pin/socket type between the lamp supplier and the fixture supplier.

I. In congested areas with exposed structure ceilings and pendant mounted lighting (i.e. mechanical rooms, elevator rooms, telecom rooms, electrical rooms, etc.), locate and suspend light fixtures as required in the field to avoid obstructions and to allow for the best possible light distribution. Span underneath ductwork and other obstructions as required with independent strut supported properly from the walls or the ceiling.

J. Emergency wall mounted fixtures shall be mounted at a minimum of 82" AFF, unless otherwise noted.

K. Maintain manufacturer required clearances around fixtures (such as 3” around recessed downlights) in ceilings with insulation.

L. Coordinate mounting height of all wall mounted fixtures (including wall sconces and fixtures in stairwells) with the Architect prior to rough-in.

M. Secure wiring harness to clips within exit signs so that this wiring is not exposed through the exit sign panel lettering.

N. Exit signs shall be no more than 100 feet from viewing area.

O. Grid ceiling mounted recessed downlights shall be centered in tile.

P. Remove all debris from lensed fixtures including instruction sheets, bugs, etc.

Q. All ballast channel covers shall be installed as required.

R. All troffers shall have the door hinges secured.

3.2 CLEANING

A. Clean all exposed aluminum reflector surfaces with warm soapy water and a clean towel to eliminate fingerprints immediately after accidental touching of surfaces.

B. Remove all cardboard, manufacturer’s stickers, plastic covers, etc. from final installed light fixtures.

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal. Perform tests after units have been charged for a minimum of 24 hours. Batteries shall be tested for 90 minutes.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 265100

SECTION 265600 – EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Luminaire-mounted photoelectric relays.
3. Poles and accessories.
4. Luminaire lowering devices.

B. Related Sections include the following:

1. Section 265100 "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings and lamp and ballast information.
2. Section 260529 "Hangers and Supports for Electrical Systems" for seismic supporting criteria.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. HID: High-intensity discharge.

C. Luminaire: Complete lighting fixture, including ballast housing if provided.

D. Pole: Luminaire support structure, including tower used for large area illumination.

E. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4.

C. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.

1. Wind speed for calculating wind load for poles is **130 mph (209 km/h)**.

1.5 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions, material type for housing/ door frame/trim/lens/reflector/etc., effective projection area, mounting information, and efficacy and illuminance-efficiency data.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Emergency lighting units and battery packs including battery and charger information.
5. Ballast/Driver type, input voltage(s), sound transmission type, temperature operating limits, ballast factor, line current amperes, and power factor. Ballast cut sheet shall be separate from ballast manufacturer and not listed as an option or type on the fixture cut sheet.
6. Lamp type, life in hours, temperature in Kelvin, output in watts, Color Rendering Index, TLCP compliance, coated or clear, lamp pin/socket configuration, lamp orientation, and initial and mean lumen output for lamps. Lamp cut sheet shall be separate from lamp manufacturer and not listed as an option or type on the fixture cut sheet.
7. Photoelectric relays.
8. Materials, dimensions, and available finishes of poles.
9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
10. Anchor bolts for poles.
11. Provide manufacturer’s point by point illumination study for each of the areas listed below:

    a. All site lighting areas away from building.

12. Point by point calculations to include the following:

    a. Point-by-point calculations of horizontal and vertical illuminance, at close grid size for viewing within the project area.
    b. Total electrical load, in kilowatts, of lighting system.
    c. LLF, LLD used in calculations.
    d. Summary table showing AVG, MAX, MIN, MAX/MIN, AVG/MIN, COEF VAR, UNIF GRAD.
    e. Location of fixtures with types.

13. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, drivers, ballasts, and accessories.

a. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

14. Manufactured pole foundations.

B. Shop Drawings:

1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
2. Design calculations, certified by a qualified professional engineer, indicating foundations, reinforcement, excavation, and backfill based on soil conditions report for the project site.
3. Wiring Diagrams: Power and control wiring.

C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that pole and foundation are designed for indicated wind loading requirements in AASHTO LTS-4 including the EPA load imposed by the mounting type and quantity of luminaries with a 1.3 gust factor.

D. Qualification Data: For agencies providing photometric data for lighting fixtures.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

D. All fixtures shall be UL listed and have UL labeling on the fixtures according to the type of useage.

E. Mockups: Provide interior lighting fixtures for room or module mockups, complete with power and control connections, where indicated in the construction documents by Architect or Engineer.

1. Obtain Architect's approval of fixtures for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved fixtures in mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Package aluminum poles for shipping according to ASTM B 660.

C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch (6 mm) deep. Do not apply tools to section of pole to be installed below ground line.

D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.

E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

B. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified either in these specifications or on the lighting fixture schedule on the drawings.
2. Substitutions: Substitutions will only be allowed to be submitted for pre-approval to the Engineer up to ten days prior to bid opening. The substitutions will be reviewed at that time by the Engineer. Substitution materials and equipment will only be incorporated into the project if the Engineer pre-approves the shop drawing(s) and lists the manufacturer's make and model on an official written and distributed Addendum. No substitutions will be reviewed by the Engineer during construction.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires. Refer to drawings for individual distribution patterns per fixture.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. House Side Shields: Metal baffles, factory installed and arranged to block light distribution to indicated portion of normally illuminated area or field. Refer to drawings for individual house side shields per fixture.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

a. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

a. Color: As selected by Architect from manufacturer's full range.

2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with NEMA C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.4 DRIVERS, BALLASTS AND LAMPS

A. Refer to Section 265100 “Interior Lighting” for ballast and lamp information.

2.5 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-4.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
3. Anchor-Bolt Template: Plywood or steel.
4. Anchor-Bolt Cover Plate: Aluminum or steel.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 26 "Common Work Results for Electrical."

E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

F. Coordinate anchoring of light poles on bases provided by others (i.e. top level of parking deck).

2.6 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); 1-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.

1. Shape: Refer to drawings.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
3. Hinged Type, where indicated on drawings: Provide hinged type poles and one (1) manual winch, arm, rotating steel drum with two-way ratchet lock and 35’ of stranded flexible aircraft cable.

B. Steel Mast Arms: Refer to drawings for type, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
2. Cross Section: Oval or square to match pole type, with end section to accommodate luminaire(s).
3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch (381-mm) vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet (3 m) above finished grade.

F. Handholes: Weathertight, 3-by-5-inch (76-by-127-mm) handhole located at base of pole with cover for access to internal welded attachment lug for ground connection, in-line splices, and cable support. Lug to be welded 1/2-inch (13-mm) lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

G. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.

H. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build powder coat.

a. Color: As selected by Architect from manufacturer's full range.

2.7 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.

1. Shape: Refer to drawings.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Oval or square cross section, with end section to accommodate luminaire(s).
2. Finish: Same as pole and luminaire.

F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

a. Color: As selected by Architect from manufacturer's full range.

2.8 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Section 262726 "Wiring Devices" for ground-fault circuit-interrupter type, when indicated on the drawings.

1. Recessed, 12 inches (300 mm) above finished grade.
2. Reinforced fiberglass cover, that when mounted results in NEMA 250, Type 3R enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

D. Be aware of any potential light trespass issues and notify Architect prior to installation.

E. Coordination: Coordinate lamp base, lamp orientation, and lamp pin/socket type between the lamp supplier and the fixture supplier.

F. Fusing: Provide in-line step-down fuses in the pole access hole for pole mounted fixtures or fixture housing for ground mounted luminaires when luminaire is HID type or when circuit supplying power is over 20 amperes.

G. Fixtures/Housings Recessed in Concrete Wall or Floor: Acquire housing and/or backplate prior to floor or wall construction. Install raceway and backbox assembly in floor or wall at time of erection. Install wall mounted fixture according to coursing of block in the field.

3.2 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 26 "Common Work Results for Electrical."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.

3. Install base covers, unless otherwise indicated.
4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Dig holes large enough to permit use of tampers in the full depth of hole.
2. Backfill in 6-inch (150-mm) layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.

1. Make holes 6 inches (150 mm) in diameter larger than pole diameter.
2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
3. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
4. Cure concrete a minimum of 72 hours before performing work on pole.

G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable).

I. Provide concrete base bumper guard above grade, where indicated on drawings. Utilize sonotube for round bases and wooden forms for square bases, as indicated on drawings. Provide 1” chamfer around top edge of base. Strip off sonotube or forms when concrete has cured and patch voids by trowelling with non-shrink grout and finishing smooth.

3.3 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Provide excavation and gravel backfill and concrete base. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling with non-shrink grout and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 26 "Common Work Results for Electrical." Coordinate with landscaping.

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES PROTRUDING ABOVE GRADE

A. Align units for optimum directional alignment of light distribution.

B. Provide excavation and gravel backfill and concrete base. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 26 "Common Work Results for Electrical." Coordinate with landscaping.

3.5 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES FLUSH WITH GRADE

A. Align units for optimum directional alignment of light distribution.

B. Provide excavation and gravel backfill and concrete base. Install flush with finished grade.

3.6 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.7 HANDHOLES

A. Where conduits/cables entering and exiting poles or ground mounted luminaries cannot be spliced with the pole/fixture, provide adjacent handholes at each pole/fixture for splicing purposes. Refer to Section 260544 “Underground Utility Structures” for further information on handholes.

3.8 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole, unless otherwise indicated.

B. Ground nonmetallic poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole.
2. Ground metallic components of pole accessories and foundations.

3.9 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measure light intensities at night as directed by Engineer. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting."
b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
d. IESNA LM-64, "Photometric Measurements of Parking Areas."
e. IESNA LM-72, "Directional Positioning of Photometric Data."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.10 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires. Refer to Section 260500 “Common Work Results for Electrical.”

END OF SECTION 265600

SECTION 27 10 00

COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.01 REQUIREMENTS

Contractor shall review all other documents for additional requirements and information that apply to the Work. If conflicts between this section and/or the general requirements and general conditions occur, the more stringent shall apply. Contractor shall deliver the complete communications system, including any design-build requirements of this section and the following drawings:

TN-001	Sheet Index and Notes
TN-100	Overall Floor Plans
TN-101A	First Floor Plan – Area A
TN-101Bn	First Floor Plan – Area Bn
TN-101Bs	First Floor Plan – Area Bs
TN-101C	First Floor Plan – Area C
TN-102C	Second Floor Plan – Area C
TN-501	Rack Elevations and Details
TN-701	Coordination Details
TN-801	MDF Room (1122) Enlarged Plans
TN-802	IDF Room (1810) Enlarged Plans
TN-803	IDF Room (2810) Enlarged Plans

1.02 PROJECT DESCRIPTION

A. General:
   1. Work includes the installation work for the entire voice/data infrastructure and cabling system throughout the addition space. All materials, installation and commissioning for the entire system is included under this scope of work, whether specifically delineated or not.
   2. Installation of backboxes and wall box connectivity points for OFE touch panel displays within each classroom.
   3. The Contractor shall be responsible for coordination with the work of all other trades for these systems.

1.03 SCOPE OF WORK

A. The Contractor shall provide a turn-key system installation including, but not limited to, the installation of all low voltage, technology cable (backbone and horizontal station), jacks, faceplates, outlet housings, blank cover plates, patch panels, racks, cabinets, cable runway, TR cable trays and supports, cable ties, termination blocks, cross connect wire, patch cords, grounding, installed equipment, any miscellaneous items, labor and services required for a complete, standards and code-compliant communications system for the entire facility to meet the functional requirements outlined in this section.

B. Labeling per TIA/EIA 606A:
   1. At each workstation technology outlet, cable, faceplate and jack in the Work.
   2. At each telecommunications room, cable, patch panel port, punch-down location, rack, cabinet, and termination location in the Work.

C. Fire stopping all telecommunication penetrations through the building structure as required by fire separations.

D. Verification testing and documentation of each installed cable from the patch panel or termination block to the termination jack.

E. Field verify site conditions including dimensions and clearances of all outlet locations (wall, floor, and furniture) prior to installation. Prior to installation by the Contractor, the Owner will confirm furniture termination locations.

F. The Contractor will be held responsible to have examined the site and premises. They will be presumed to have satisfied themselves as to existing conditions under which they will be obligated to perform the work or that which will affect the work under this contract in any way.

G. Permits: Obtain any necessary permits for the execution of this work in conformance with applicable union regulations, local, State and Federal codes and regulations.

H. All aesthetic issues are to be coordinated and approved by the Owner, Architect, and Designer.

I. Removal and reinstallation of any ceiling tiles that may be in place during the cable infrastructure installation that may hinder the telecommunication work. Contractor is also responsible for the replacement of any damaged ceiling tiles that are removed for the telecommunication work.

J. Patch, repair, finish and paint any surfaces that are damaged or demolished for access during this work. Room finishes to be returned to initial condition.

K. Coordinate with other trades to ensure that all required access and clearances to equipment and services are provided and maintained.

L. Conduct testing and adjustment. Submit documentation required by this section. Participate in approval testing for acceptance by the Owner. Perform final adjustments as required to by this section.

M. Verification testing and documentation for all backbone and tie cable as required by this section.

N. Deliver to the Owner, bound "as-built" system documentation. Transfer all warranties and equipment guarantees to the Owner, at the time of acceptance of the work by the Owner.

O. Provide system operation training as specified in Part 3 of this section.

P. Provide, size, and install all conduit and penetrations, wire raceways, back boxes, and cabling connecting system components, as required by the communications system, not installed by the General Contractor.

Q. Verify 120/208-volt AC power requirements and grounding busbar for each equipment location. Provide and coordinate installation of any additional or related cabling, or conductor circuits.

R. Communications drawings depicting equipment installation and wiring are diagrammatic. The responsibilities for all types and final cable lengths throughout all phases of the Work are that of the Contractor.

S. Provide size, and install all conduit and penetrations, wire raceways, back boxes, and cabling connecting system components as required by the Communication System, not installed by the General Contractor.

T. Verify all conduit and penetrations, wire raceways, back boxes, mounting hardware to building structure, and cabling connecting system components, as required by the Communication System and installed by the General Contractor/Electrical Contractor as part of the base building fit out. Notify Owner of any discrepancies that may exist between the Shell Contract Documents and existing conditions.

1.04 QUALITY ASSURANCE

A. All materials must be newly manufactured current production models and conform to all applicable codes and the relevant standards listed below:
1. American National Standards Institute (ANSI)
2. Institute of Electrical and Electronic Engineers (IEEE)
3. Electronic Industries Alliance (EIA)
4. Telecommunication Industries Association (TIA)

B. Experience: The Contractor shall specialize in the installation of communications systems, have a minimum of five years of documented experience in the field of communications system installation and be a manufacturer approved vendor for all of the components installed.

C. Supervision: Contractor shall designate a Project Manager and Foreman/Project Supervisor to oversee the installation work for the duration of the Work, to ensure that the system is installed in accordance with the section and drawings.
1. Project Manager shall maintain adequate staff and be responsible for installing and testing the system on schedule.
2. Project Manager and Foreman/Project Supervisor shall have at least five years of documented, recent and similar project experience.

D. Contractor shall promptly notify the Owner, in writing, of any difficulties that may prevent proper coordination or time of completion of the Work. Failure to do so shall constitute acceptance of work and indicate that the site is suitable in all ways for this Work, except for defects that may develop in the work of others after commencement of system installation.

E. Insurance: Provide evidence of insurance for the full value of equipment and material located on-site. Insurance shall cover losses due to fire, theft and vandalism, until the final acceptance of the system, by the Owner. Maintain additional liability insurance to protect the supplier and/or Owner, Architect, Designer against damage claims for personal injury, including death, which may arise during the performance of this work.

1.05 MANUFACTURERS QUALITY ASSURANCE

A. Manufacturers must have a minimum of seven years experience manufacturing equipment designed specifically for voice and data communication networks. Manufacturers must be nationally known and recognized as competent in the construction and communication industries.

B. Where this section and/or project drawings call for an installation to be made in accordance with the manufacturer's recommendations, a copy of such recommendations shall always be kept on the job site, and shall be available to the Owner’s representative and the Architect.

C. The Contractor shall follow manufacturer's instructions where they cover points not specifically indicated on in this section and/or project drawings. If the manufacturer's instructions differ from what is called for in this section and/or the project drawings, it is the responsibility of the Contractor to obtain clarification from the Owner's representative in writing before commencing work.

1.06 REFERENCES

A. General:
1. All work must conform to the most stringent of applicable codes. If during installation the Contractor identifies work that does not meet the most stringent code, the Contractor is to stop work immediately on that portion of the project and notify the Owner's representative in writing.
2. The Contractor must understand and have a working knowledge of all applicable codes and standards governing the Work.
3. The Contractor must follow the most current standard/code or the edition utilized by the authority having jurisdiction.

B. Codes:
1. National Electric Code, (NEC)
2. National Electric Safety Code (NESC)
3. National Fire Protection Association (NFPA) codes
4. State Codes:
   a. STS-1000 Telecommunications Wiring Guidelines
   a. Electric code
   b. Building code
5. Local Municipal Codes:
   a. Electric code
   b. Building code

C. Industry Standard Requirements:
1. Underwriters Laboratories (UL)
2. Institute of Electrical and Electronic Engineers (IEEE):
   a. IEEE 802.3 Ethernet
   b. IEEE 802.11 Wireless LAN
3. ANSI/TIA:
   a. ANSI/TIA-526-7-A Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant
   b. ANSI/TIA-526-14-C Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant
   c. ANSI/TIA-568.0-D Generic Telecommunications Cabling for Customer Premises
   d. ANSI/TIA-568-C.2 Balance Twisted Pair Communications and Components Standards
   e. ANSI/TIA-568-C.2-2 Balanced Twisted-Pair Telecommunications Cabling and Components Standard, Addendum 2: Additional Considerations for Category 6A Patch Cord Testing
   f. ANSI/TIA-568-C.4 Broadband Coaxial Cabling Components Standard
   g. ANSI/TIA-568.1-D Commercial Building Telecommunications Infrastructure Standard
   h. ANSI/TIA-569-D Telecommunications Pathways and Spaces
   i. ANSI/TIA-598-D Optical Fiber Cable Color Coding
   j. ANSI/TIA-606-B Administration Standard for Telecommunications Infrastructure

k. ANSI/TIA-606-B-1 Administration Standard for Telecommunications Infrastructure Addendum 1- Automated Infrastructure Management Systems - Addendum to ANSI/TIA-606-B
l. ANSI/TIA-607-C Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
m. ANSI/TIA-758-B Customer-Owned Outside Plant Telecommunication Infrastructure Standard
n. TIA-862-B Building Automation Systems Cabling Standard
o. ANSI/TIA-942-A Telecommunications Infrastructure Standard for Data Centers
p. ANSI/TIA-942-A-1 Telecommunications Infrastructure Standard for Data Centers, Addendum 1 - Cabling Guidelines for Data Center Fabrics
q. ANSI/TIA-1005-A Telecommunications Infrastructure Standard For Industrial Premises
r. ANSI/TIA-1005-A-1 Telecommunications Infrastructure Standard For Industrial Premises, Addendum 1- M12-8 X-Coding Connector - Addendum to TIA-1005-A
s. ANSI/TIA-1183-1 Measurement Methods and Test Fixtures for Balun-Less Measurements of Balanced Components and Systems, Extending Frequency Capabilities to 2 GHz - Addendum to TIA-1183
t. ANSI/TIA-1152 Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
u. ANSI/TIA-1179 Healthcare Facility Telecommunications Infrastructure Standard
v. ANSI/TIA-1183 Measurement Methods and Test Fixtures for Balum-Less Measurements of Balanced Components and Systems
w. ANSI/TIA-4966 Telecommunications Infrastructure Standard for Educational Facilities
x. TIA-104-B, FOTP-104 Fiber Optic Cable Cyclic Flexing Test
y. TIA-455-25-D, FOTP-25 Impact Testing of Optical Fiber Cables
z. TIA-604-18, FOCIS 18 Fiber Optic Connector Intermateability Standard – Type MPO-16
aa. TIA-604-5-E, FOCIS 5 Fiber Optic Connector Intermateability Standard – Type MPO
bb. TIA-5017, Telecommunications Physical Network Security Standard
cc. TIA-TSB-155-A Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T
dd. TIA-TSB-184 Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling
ee. TIA-TSB-4979 Practical Considerations for Implementation of Multi-mode Launch Conditions in the Field
ff. TIA-TSB-190 Guidelines on Shared Pathways and Shared Sheaths
gg. TIA-TSB-162-A Telecommunications Cabling Guidelines for Wireless Access Points
hh. TIA-568-C.3 Optical Fiber Cabling Components Standard
ii. TIA-568-C.3-1 Optical Fiber Cabling Component Standard- Addendum 1, Addition of OM4 Cabled Optical Fiber and array connectors

4. ISO/IEC
   a. ISO/IEC 11801 - Information Technology – Generic Cabling For Customer Premises
   b. ISO/IEC TR 11801-99-1 – Balanced cabling for 40Gbps channels
   c. ISO/IEC 15018 - Information Technology – Generic Cabling for Homes
   d. ISO/IEC 24702 - Information Technology – Generic Cabling – Industrial Premises
   e. ISO/IEC 24764 - Information Technology – Generic Cabling Systems For Data Centres

f. ISO/IEC 24764-1 - Data Centers - Amendment to add Intermediate Distributor (ID) for large or modular data centers
g. ISO/IEC 14763-2 - Implementation and Operation of Customer Premises Cabling – Part 2: Planning and Installation
h. ISO/IEC 14763-3 – Testing of Optical Fiber Cabling – methods for inspection and testing of installed optical fiber
i. ISO/IEC TR 29125 - Information technology -- Telecommunications cabling requirements for remote powering of terminal equipment

5. ASHRAE:
   a. ASHRAE Standard 90.4P, Energy Standard for Data Centers and Telecommunications Buildings
6. BICSI – Building Industry Consultative Services International:
   a. BICSI 004, Information Technology Division Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities
   b. ANSI/BICSI 005, Electronic Safety and Security (ESS) System Design and Implementation Best Practices
   c. Information Transport Systems Installation Methods Manual (ITSIMM)
   d. ANSI/BICSI 002, *Data Center Design and Implementation Best Practices*
   e. Network Systems and Commissioning (NSC) reference, 1st Edition
   f. ANSI/NECA/BICSI 568, Standard for Installing Commercial Building Telecommunications Cabling
   g. NECA/BICSI 607, Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings
   h. ANSI/BICSI 001, Information Transport Systems Design Standard for K-12 Educational Institutions
   i. BICSI-003 Building Information Modeling (BIM) Practices for Information Technology Systems
   j. Telecommunications Distribution Methods Manual
   k. AV Design Reference Manual
   l. Network Design Reference Manual
   m. Outside Plant Design Reference Manual
   n. Wireless Design Reference Manual
   o. Electronic Safety and Security Design Reference Manual
   p. Commercial Installation On-the-Job Training Booklet
   q. Telecommunications Project Management (TPM) reference
7. Rural Utilities Service (RUS):
   a. Bulletin 1753F-201: RUS Standard for Acceptance Tests and Measurements of Telecommunications Plant

1.07 SUBMITTALS

A. Contractor shall comply with the general requirements and general conditions of this section.

B. Bid submittals. Contractor shall submit the following qualification documents with the bid proposal:
   1. Firm description of the Contractor, and a copy of the Contractor's license, as well as a statement regarding the relationship of the license holder to the Contractor.
   2. Provide a minimum of ten related projects, four of which must have been completed within the last 12 months. Provide a full description of work, bid price, cost of change orders, reason for change orders, owner representative's name, telephone number and email address for each project.
   3. Résumé of Project Manager and Foreman/Project Supervisor documenting related experience. Foreman/Project Supervisor must have completed at least two similar installations in the past 12 months.

4. Submit a list including names, firm description, job foreman, copy of license and scope of work, for any subcontractors whose work would be part of this contract.
5. Submit insurance certificates - amount and type of liability as required by Owner.
6. Submit proof of Contractor's worker's compensation coverage.
7. Data manufacturers:
    a. Specific pre-approved manufacturers are listed in this section. This list must be adhered to throughout the bidding and installation phases of the project. The bidder may suggest other paired manufacturers to be used based on the criteria outlined in this section, but these alternate manufacturers must be presented as an equal to the pre-approved manufacturers listed below. The suggested alternates may not be approved by the Owner and therefore must be presented secondarily with the approved manufacturers to be considered.
    b. The bidding Contractor must also provide specific part numbers for all components in the channel/link solution. Only general guidelines are provided below with respect to manufacturers. Final approval of suggested/bid products is up to the Owner.
    c. The preferred manufacturers/systems are:
        i. Panduit/Belden
        ii. Berktek/Leviton
    d. Other acceptable manufacturers include:
        i. Legrand/Superior Essex
        ii. AMP/TE Connectivity
        iii. Corning
        iv. Ortronics
        v. Hubbell
        vi. Erico
        vii. Siemon/CommScope
        viii. Chatsworth
        ix. Southwest Data Products
        x. Nelson
    e. The bidder is to take into consideration the consequences of pairing up component and cable manufacturers to the overall warranty of the system. The Owner considers this system as a whole and requires an integrated component/cable warranty on all material and labor as described below.
    f. Refer to the project documents and this section for more detailed descriptions of products. The bidder is required to include all components necessary to provide a complete technology system as described in this section and noted in the associated project drawings.
8. Submit a detailed list of equipment and materials to be provided for the Work specified herein and on the project drawings. Include a list of the items for which submittals will be provided.
9. Submit manufacturer's product cut sheet documentation for the following materials and/or equipment, clearly noting each product and part number for review and approval:
    a. Equipment racks
    b. Equipment cabinets
    c. All related seismic restraints
    d. All cable types (copper and optical fiber)
    e. All patch bays (fiber, copper and coax)
    f. All connection/termination blocks (copper)
    g. All technology outlets housing material
    h. All technology outlet jack types and housings
    i. All cable support material (cable runway, j-hooks, etc)
    j. Fire stop material
10. Submit bid pricing worksheet for review with bid

a. Bidder is to generate a pricing worksheet that indicates manufacturer, manufacturer part number and product costs plus installation costs for review by the Owner.
b. Bidder is to itemize any miscellaneous materials.
c. All costs in the bid pricing worksheet are to be inclusive of a turn-key communications system installation.

11. Submit a constant price affidavit - pricing good for one year from date of submittal.
12. Submit manufacturer's 25-year extended warranty statement.
13. Submit Contractor's 1-year warranty and service statement.
14. Provide a statement indicating all materials are readily available. If not, provide a recommended solution as an alternate.
15. Submit any other information and copies as required in the project's general requirements and Owners' supplemental information.

C. Construction submittals:
1. Submittals to be submitted three weeks after written notification to proceed.
2. Before ordering equipment, submit catalog data sheets, neatly bound with title page, space for submittal stamps and tabbed dividers between sections. List all equipment with reference to corresponding section paragraph numbers or equipment title. Denote all approved substitutions.
3. Provide shop drawings and record drawings using the following scales:
   a. Plans - not less than 0.125-inch = 1-foot
   b. Details - not less than 0.25-inch = 1-foot
4. Submit point-to-point wiring diagrams and typed wire lists identifying every connection. Indicate location of all components. Identify cables by type, color and wire number.
5. Submit detailed floor plans, reflected ceiling plans, sections and elevations of all telecommunication rooms illustrating termination locations and associated wiring scheme.
6. Submit system plans showing all device locations.
7. Submit conduit riser diagrams showing connection of all devices along with types and quantities of cables to be used and cable identification tags.
8. Submit conduit, sleeve and cable tray fill calculations.
9. Submit rack layouts indicating the proposed arrangement of mounted equipment.
10. Submit fully dimensioned construction details of all coordination items, such as panel or plate installation in casework or millwork.
11. Submit a schedule of finishes indicating proposed materials and color selections options (from manufactures standard finishes) for approval by Owner/Architect.
12. Submit samples of engraved labels, cable-marking system, and faceplate etching/finishes.
13. Submit complete mockups of all faceplate types and verification that they are compatible with the locations and enclosures, including floor boxes and furniture, in which they will be installed.
14. Submit samples of any cabling, device, or other IT system element that is being presented as an alternate.
15. Submit mounting and support details for equipment racks, cable trays, and all other items mounted overhead, complete with parts lists and dimensions. Include a full plan view, front elevation and side elevation of each item, with corresponding support structure and mounting hardware. Verify load ratings of all hanging components including attachment hardware. A structural engineer registered in the State shall stamp details.
16. Validation walkthrough submittals: Prior to requesting the validation walk through, submit copies of all "as-built and test report information" required in Part 3 of this section to the Designer.

1.08 PROJECT CLOSE OUT

A. The Contractor shall provide type written and computer readable documentation, which indicates materials acceptance testing was conducted as outlined in this document. The Contractor shall also provide documentation that indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion for Owner/Designer analysis.

B. After approval of the copy of all as-built and test report documents, submit the following to the Architect:
   1. Two sets of full size prints
   2. Three sets of reduced B or half size prints whichever is larger.
   3. Five bound sets of all paper test results in three-ring binders. Divide information into sections and binders as required to fit into a maximum of 3-inch D-ring binders.
   4. Five project close out DVD/CD-ROM disks.

C. As-built drawings:
   1. Maintain a full set of shop drawings at the project site, marked up to indicate actual locations in general, the true state of the installation.
   2. Cableway and cable schematic illustrating point-to-point connections between all terminal points within the backbone cabling system.
   3. Complete riser diagram showing backbone interconnection and cable routing. Each cable type must be noted.
   4. Detailed elevations of the voice and data telecommunications room illustrating punch-down location and equipment rack locations.
   5. Equipment rack elevations illustrating vertical location of termination hardware (e.g. fiber boxes, patch panels, etc.) within all IT/telecom rooms and ceiling enclosures.
   6. Mounting and attachment details illustrating the connection of equipment racks and cabinets to the structure.
   7. Outlet layout floor plans including room/area numbers, outlet numbers and the corresponding cable identification numbers.
   8. Two sets of A size drawings showing the components and wiring in each individual rack. A drawing of each rack shall be mounted in a plastic jacket in the telecommunication room near the associated rack. The other complete drawing set shall be included in the manual.

D. Bound Manuals:
   1. Bound manuals must be:
      a. Neatly presented in a three-ring binder and tabbed into separate sections.
      b. Divide information into sections and number of binders as required.
      c. Binders are to be a maximum of 3-inch thick D-ring binders.
      d. Provide spine and front cover labels for each binder, label to call out building name, general contents of binder and volume number if multiple binders are required.
      e. Contain a table of contents.
      f. Provide the company name, address, telephone number and contact name for system service or maintenance in a clear plastic sleeve in the very front of the binder.
      g. Provide clear plastic three-ring binder sleeve for DVD/CD-ROM. DVD/CD-ROM to be located behind the table of contents of each bound manual.
   2. The “Test Report Manual” will contain the following:
      a. Cable run sheets: The information included on the run sheet shall be:
         i. Separated by each floor and then by each cable type
         ii. Cable source
         iii. Cable destination

iv. Cable type (e.g. horizontal riser, vertical riser, technology outlet, etc)
v. Generic cable section (e.g. OSP, Cat-6, fiber, etc)
vi. Manufacturer's cable section number
vii. Cable jacket color
viii. Cable label number
ix. Test results for each cable

3. The “Warranty, Operations, Maintenance Manual” will contain the following:
   a. Narration of system and patching procedures for this system.
   b. Small scale plans showing locations and circuit numbers for all system outlets and receptacles.
   c. Single-line block diagrams showing all major system components.
   d. Listing of all equipment and materials with names of manufacturers and model numbers or part numbers.
   e. Catalog data sheets displaying manufacturer’s names, addresses and telephone numbers.
   f. Results of all tests called for in Part 3 of this section.
   g. Provide a narration of any manufacturer suggested maintenance for any of the materials.
   h. Provide copies of Contractor and manufacturer warranties.

4. DVD/CD-ROM format:
   a. Submit copies of all information presented in the bound manuals on DVD/CD-ROM media.
   b. Files shall use long windows names file structure.
   c. A disk master file list in text format shall be placed on the DVD/CD-ROM with a short description of files on that disk.
   d. Architectural drawings shall be in AutoCAD 2004 or later drawing (.DWG) format. Drawing Exchange File Format (.DXF) shall not be acceptable. All XREFs, fonts, and other drawing parts necessary to the drawings shall be included.
   e. Network drawings shall be in Visio 2010 and AutoCAD 2004 or later drawing (.DWG) format. Drawing exchange file format (.DXF) shall not be acceptable. All XREFs, fonts, and other drawing parts necessary to the drawings shall be included.
   f. All test report data.
   g. Complete working copy of electronic software used to generate the test results for review by the Owner/Designer.
   h. Documents and spreadsheets shall be in Microsoft Office 2010 or later format.
   i. All files to be converted to searchable PDF files in addition to the native drawing, document and spreadsheet formats.
   j. Manufacturers’ manuals provided by the manufacturer to the Contractor or documents that are similarly not otherwise available to the Contractor in electronic format shall be excluded from this requirement.

1.09 GUARANTEES AND WARRANTIES

A. Transfer all manufacturer and subcontractor’s warranties to the Owner at the acceptance of all work.

B. Register warranty in the Owner’s name for any product with a manufacturer’s warranty of more than one year.

C. The warranty must include, but will not be limited to, the following statements regarding the cabling system:

1. "Will support and conform to TIA/EIA-568-C sections covering ANY CURRENT OR FUTURE APPLICATION which supports transmission over a properly constructed horizontal cabling system premises network which meets the channel and/or basic link performance as described in TIA/EIA-568-C."
2. "The Warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s)."
3. The warranty shall not be for less than 20-years.

D. The warranty will not begin until after a 90-day period from the final date of acceptance, by the Owner. If during this period the installed system does not perform adequately, the Contractor must repair the installation within 24-hours to the satisfaction of the Owner and this section. Provide loaner equipment as required to keep the system operational if the system cannot be repaired within 24-hours of notification.

1.10 OWNER FURNISHED EQUIPMENT

A. Certain equipment may be identified as owner furnished equipment (OFE). This OFE may presently be part of the Owner's systems or will be provided by the Owner, and will be delivered to the Contractor's off-site construction facility, delivered to the Contractor's on-site secured storage area or installed on site by others, as appropriate, for incorporation into the system.

B. Clean and inspect the OFE, and notify the Owner in writing of damage or defect and the extent of repair and/or adjustment required to bring the OFE to original specification. Service OFE only as directed by the Owner under the arrangements of a separate contract.

C. Incorporate into the system as if provided new, excepting warranty coverage.

PART 2 - PRODUCTS

2.01 GENERAL

A. Components are to operate on a 110-120 volt, 60 Hz electrical supply unless otherwise noted. Rack mounted equipment is to be mounted in a standard EIA 19-inch rack. The components listed in the equipment schedule are the basis of the system design and represent the minimum standards for each of the components. All of the properties of each component or system should be considered listed in full.

B. The components listed in the equipment schedule are the basis of the communications system design and are the owners' preferred components. They represent the minimum functional and performance standards for each of the components. All of the properties of each component or system should be considered listed in full.

C. Equipment, excepting the owner furnished equipment (OFE), and materials shall be new. The latest version at time of delivery and shall conform to applicable UL, CSA, ANSI, TIA/EIA provisions. Take care during installation to prevent scratches, dents, chips, etc.; equipment with significant or disfiguring cosmetic flaws will be rejected.

2.02 OUTLET JACKS AND CONNECTORS

A. Materials:
1. All modular data outlet jacks shall be rated to perform above the minimum TIA/EIA-568-C performance level for Category-6A.
2. All Category-6A outlet jacks shall have an eight position, eight conductor module that accepts both RJ45 and RJ11 modular plugs. Outlet jacks must utilize the TIA/EIA-T568-C pin-out wiring scheme.

3. All Category-6A outlet jacks and the associated channel components must support gigabit Ethernet transmission speeds up to ninety meters.
4. All modular Category-6A outlet jacks shall be coordinated with faceplate color.
5. All optical fiber multi-mode modular outlet jacks shall be duplex LC connectors that are rated and approved by the manufacturer to perform at the level designated by the optical fiber strands terminated within each connector.
6. Preferred UTP copper jack manufacturers:
   a. Belden
   b. Leviton
   c. Hubbell
   d. Ortronics
   e. Panduit
   f. Siemon
   g. CommScope
7. Preferred optical fiber termination connector manufacturer and systems:
   a. Corning Unicam LC system
   b. Panduit LC system

2.03 OUTLET HOUSING

A. Materials:
1. Flush mounted faceplates in all technology outlet locations shall be a minimum of four, port plates. Color of each flush-mount faceplate must be coordinated with the Architect before purchase to match the electrical faceplate trim color.
2. All outlet housing components must provide TIA/EIA-606 labeling spaces for each individual outlet jack and for the outlet housing.
3. Faceplates for wall-mounted phones shall be one-port single gang faceplates that have wall-mount lugs allowing vertical phone mounting.
4. Faceplates and connectors for floor-mounted outlets must be coordinated with the floor box that will be provided for the project.
5. Furniture faceplates and connectors shall be capable of fitting in the furniture system selected by the Owner. Quantity of faceplates and connectors shall satisfy outlet jack requirements shown on drawings. Faceplate extenders shall be provided and used by the Contractor, if required, to maintain proper bend radii. Colors must be coordinated with the Owner before purchase.
6. Preferred outlet housing manufacturers:
   a. Belden
   b. Leviton
   c. Hubbell
   d. Ortronics
   e. Panduit
   f. Siemon
   g. CommScope

2.04 CABLE

A. General:
1. All cable is to be plenum rated, unless otherwise noted.
2. All plenum cable shall be designated “non” or limited combustible and be rated CMP-50 by the manufacturer with verification available, if requested, from an independent party.
3. All cable shall be UL listed.
4. All cable manufacturing shall be ISO 9001 certified.

B. Category-6A cable:
1. All Category-6A, four pair cables will consist of eight, 20-26 gauge thermoplastic insulated solid twisted conductors that utilize the standard color code within a blue colored plenum jacket.
2. The performance criteria for the Category-6A station cables shall be in accordance with the specific standards for the particular cable's rating. A Category-6A-rated cable must perform beyond the current section parameters for the published Category-6A rating by TIA/EIA-568-C series standards before, and after installation.
3. All Category-6A cabling and the associated channel components must support ten gigabit Ethernet transmission speeds up to ninety meters.
4. Preferred Category-6A cable manufacturer and systems:
   a. Superior Essex 10Gain XP System
   b. BerkTek LANmark-XTP System
   c. Belden 10GXS System
   d. CommScope GigaSPEED X10D System

C. Multi-mode optical fiber cable:
1. All multi-mode optical fiber cable strands must be ISO/IEC 11801 Optical Multimode 3 (OM3) rated and have an outside cladding diameter of 125 micrometers and an inside core diameter of 50 micrometers with a dual operational wavelength of 850 nanometers and 1300 nanometers over distances less than 5 kilometers.
2. All multi-mode optical fiber cables must contain a series of Kevlar strands for tensile strength reinforcement and contain a dry water propellant mechanism within the metallic interlocked armor if there is a possibility of water contamination at any point in the pathway.
3. All multi-mode optical fiber cable shall exhibit stable performance in a building environment and the transmission performance of the optical fiber shall not be adversely affected by environmental fluctuations, installation conditions/methods, and/or aging.
4. All multi-mode optical fiber cable shall be OFNP-rated, and all cable jackets shall have the industry standard orange coloring, that is constructed with a metallic interlocking armor directly encased within the jacket for protection, unless otherwise noted.
5. The performance criteria for the multi-mode optical fiber cable shall be in accordance with the specific standards for the particular cable's rating by TIA/EIA-568-C.
6. Preferred multi-mode optical fiber cable manufacturer and systems:
   a. Corning Interlocking armored MIC cable system
   b. CommScope Interlocking armored cable system
   c. BerkTek Interlocking armored cable system

2.05 PATCH PANELS

A. General:
1. All patch panels are to be rack mountable within industry standard TIA/EIA, 19-inchmounting rails.
2. Unused ports or slots are to have blank inserts installed.
3. Panels are to be UL-listed.
4. All patch panels shall be produced by the same manufacturer that produces the outlet jacks for that system.

B. UTP patch panels:
1. All installed UTP patch panels shall be forty-eight (48) port Category-6A patch panels with a 110-style termination connection on the back of the panels and a single RJ45 module on the front for each port, unless otherwise noted on the project drawings.

2. All installed UTP patch panels shall include horizontal cable management brackets directly behind the 110-style termination point.
3. The performance criteria for the UTP patch panels must exceed the Category-6A parameters for frequency, attenuation, near end cross-talk (NEXT), attenuation to cross-talk ratio (ACR), power sum NEXT (PS-NEXT), power sum ACR (PS-ACR), equal level far end cross-talk (EL-FEXT), power sum far end cross-talk (PS-FEXT), and return loss (RL) as set forth in TIA/EIA-568-C.
4. UTP patch panels are to utilize the TIA/EIA-T568-C pin-out termination scheme.
5. UTP patch panel manufacturer and systems:
   a. Panduit shall be the preferred patch panel manufacturer.

C. Optical fiber patch panel trays:
1. All optical fiber patch panel trays shall be either 12-port, 24-port, 48-port or 96-port optical fiber trays that are modular in design and are able to accept various types of optical fiber connectors, and specifically LC connectors, unless otherwise noted on the project drawings.
2. All optical fiber patch panel trays and associated bulkhead inserts shall have factory numerical labeling included in the design and presentation to the user side of the panel.
3. All optical fiber patch panel trays must include bend radius control in the front of the panel for optical fiber patch cords and bend radius control inside the tray for optical fiber strand protection.
4. The optical fiber patch panel bulkheads that house the terminating modules for the fiber cabling and any station optical fiber cabling shall accept TIA/EIA-568-C standard-compliant LC connectors.
5. All fiber is to be terminated in fiber shelves/patch panel trays in counts indicated on the project drawings. In general, fiber will be terminated by type, i.e., all multi-mode terminated in one shelf and all single mode terminated in one shelf. However, the product must also have the capability of terminating both single-mode and multi-mode fiber in the same shelf/patch panel tray, if necessary.
6. All termination modules are to have LC duplex connectors within the fiber tray(s).
7. Optical fiber patch panel tray manufacturer and system:
   a. Panduit shall be the preferred fiber panel manufacturer.

2.06 PATCH CORDS

A. General:
1. All patch cords are to be shipped pre-assembled, verified and tested from the factory in sealed packages.
2. On-site terminations will not be allowed under any circumstances.
3. All patch cords shall be manufactured by the same manufacturer that produces the outlet and/or backbone connectivity components of system.
4. All patch cords shall be approved by the Owner in writing prior to purchase.

B. Category-6A copper patch cords:
1. All copper patch cords shall have stranded conductors that match the TIA/EIA-568-C performance characteristics of the solid conductor Category-6A cable specified.
2. All Category-6A patch cords must utilize the TIA/EIA-568-C wiring scheme.
3. All Category-6A voice and data patch cord colors are black.
4. All Category-6A patch cord counts and lengths are noted in this section.

C. Multi-mode optical fiber patch cords:
1. All multi-mode optical fiber patch cords must be LC duplex type cords.
2. All multi-mode optical fiber patch cord colors are orange.
3. All multi-mode optical fiber patch cord counts and lengths are to be confirmed with the Owner prior to purchase.

D. The Contractor shall provide all patch cords required within the telecommunications rooms to meet functional requirements of the contract documents as well as the following additional category-6A patch cords in white:
   1. (70) – 5’ patch cords
   2. (10) – 10’ patch cords
   3. (10) – 20’ patch cords

E. The Contractor shall provide all patch cords required within each office and classroom to meet functional requirements of the contract documents as well as the following additional category-6A patch cords in blue:
   1. (6) – 10’ patch cords

F. The Contractor shall provide all patch cords required within each CTE room to meet functional requirements of the contract documents as well as the following additional category-6A patch cords in blue:
   1. (40) – 6’ patch cords

G. The Contractor shall provide all patch cords required within each Science Lab and Resource room to meet functional requirements of the contract documents as well as the following additional category-6A patch cords in blue:
   1. (15) – 6’ patch cords

2.07 WIRE MANAGEMENT

A. All horizontal wire management on 19-inch relay racks shall be one-RU and two-RU panels, as noted on the project drawings. All 19-inch horizontal managers must have sufficient depth to allow for TIA/EIA-568-C standard copper and fiber bend radii.

B. All vertical wire management on 19-inch relay racks shall be six inches in width as noted on the project drawings. Vertical wire managers will be single and double sided, as noted. All 19-inch vertical wire managers must have sufficient depth to allow for TIA/EIA-568-C standard copper and fiber bend radii.

C. Wire management manufacturer and systems:
   1. Panduit shall be the preferred wire management manufacturer.

2.08 CABLE RUNWAY SYSTEM

A. All industry one and one-half inch high standard cable runway shall be manufactured with tubular steel rails 12-inches, 18-inches, or 24-inches, in width configured with industry standard one and one-half inch ladder cross bars positioned twelve inches on center perpendicular to the rails, as called for on the project drawings. Wire frame runway systems are not acceptable.

B. Cable runway system shall include all components to install the support and bracing system including but not limited to: runway rails, end caps, wall angle support brackets, bonding straps, butt splice kits, junction splice kits, and top rack-to-runway mounting kits.

C. All cable runway system components shall be grounded and bonded per TIA/EIA-607 standards.

D. All cable runway system components shall be anodized, unless otherwise noted.

E. Preferred cable runway system manufacturers and systems:
1. Chatsworth Cable runway system
2. SWDP Cable runway system
3. Cooper B-Line Cable runway system

2.09 RELAY RACKS

A. All open frame relay racks shall be aluminum, EIA standard 19-inches wide by 7-feet high height, with four posts and 45-RU of useable space.

B. All open frame relay rack shall include components to brace it to the structure below and seismically braced from above as required for Zone 4, and noted on the project drawings.

C. All open frame relay racks shall be grounded and bonded per TIA/EIA-607 standards.

D. All open frame relay racks shall be anodized, unless otherwise noted.

E. Racks are to be rated for the Uniform Building Code Seismic Zone 4.

F. Power strips:
1. Vertical mount power strips are to be provided at the rear of each rack, with pigtails connected to power receptacles provided by others.
2. The power strip shall have a minimum of fourteen (14) 20Amp 120VAC receptacles.
3. For racks with UPS, route pigtail to UPS receptacles.

G. Relay rack manufacturers and systems:
1. Panduit shall be the preferred rack manufacturer.

2.10 CABLE TIES

A. All cable ties and all Velcro cable wraps shall be provided inside each IT/telecom room and where necessary per industry and TIA/EIA-568-C standards.

B. Velcro cable wraps shall be used IT/telecom room; nylon style cable ties shall not be used in any of the wire management systems in the IT/telecom room.

C. Velcro cable wraps shall be used for patch cords where installed to help manage patch cords.

D. Acceptable cable tie manufacturers:
1. Velcro Velcro cable ties
2. Leviton Velcro cable ties
3. Hubbell Velcro cable ties
4. Ortronics Velcro cable ties
5. Panduit Velcro cable ties
6. Siemon Velcro cable ties

2.11 FIRE STOPPING

A. All fire stopping material associated with the telecommunications transport system shall comply with all applicable laws, regulations, standards, and codes and shall be re-enterable by design.

B. All fire stopping material shall re-establish the integrity of fire-rated walls, floors, ceilings, etc when these barriers are either partially or completely penetrated by cables, conduit, slots and other penetration elements.

C. All fire stopping shall ensure that all floor and wall penetrations comply with the "F" and "T" ratings of ASTM E-814 after all work has been completed. Thickness or depth of fire stopping material(s) shall be as recommended by the material manufacturer and backed by formal ASTM E-814 tests.

D. All fire stopping material shall provide fire-resistance protection using a mechanical fire stop system that consists of pre-manufactured elastomeric components shaped to fit around standard cables, tubes, and conduit.

E. If a non-mechanical fire stop system is to be used, the Contractor shall state what form will be used and state the properties of the material to be used in each specific situation, i.e., putty (with intumescent sheet materials, ceramic fiber or rock wool fill), caulk, silicone foam, pre-manufactured "pillows", or other materials of a cement-like nature.

F. All fire stopping materials and methods shall be approved by the Owner prior to purchase and installation.

G. Preferred fire stopping manufacturer:

1.	Nelson	Firestop material
2.	3M	Firestop material

2.12 CABLE TESTER

A. The utilized cable tester shall be a Level-III compliant tester certified by an independent laboratory such as ETL.

B. The Owner requires that the Contractor utilize the following specific testers to ensure proper verification of the installed cable plant:

1.	Fluke	CableIQ Qualification Tester
2.	Ideal Networks	LanTEK III

2.13 LABELS

A. All labels shall be machine-manufactured by a labeling machine provided by the Contractor and must have a neat and uniform appearance.

B. Handwritten labels will not be accepted.

2.14 INTERCOM

A. Basis of design for the intercom system will follow (expand) the existing Bogen Communications, Inc Quantum Multicom IP specification as provided by Bogen Communications, Inc.

B. Loudspeakers are to be ceiling mounted devices.

C. Intercom loudspeakers to be adjusted to 2W SPL level within the software.

D. Exterior intercom to be Bogen ADP1 two-way terminal.

PART 3 - EXECUTION

3.01 GENERAL

The following is required for acceptance of the communications system by the Owner:

A. Install complete and functioning communications system.

B. Label equipment and cables corresponding to functional diagram.

C. Conduct adjustments and testing.

D. Report results of testing along with system documentation.

E. Participate in validation walkthrough and deliver final system and documentation.

F. Conduct any adjustments or re-testing required to meet the performance sections.

G. Provide training to an individual(s) designated by the Owner/Architect/Designer.

H. Complete the work as called for in this section and on the project drawings.

I. The Contractor's personnel shall be knowledgeable of the following communication practices:
   1. Color coding of telephone cables
   2. Bonding and grounding of shields
   3. Testing conductors for electrical continuity, polarity and sequence
   4. Special handling of fiber optic cable assemblies
   5. Industry-standard cable termination methods, such as, but not limited to: 110 connector blocks, RJ jacks, and fiber connectors
   6. TIA/EIA-568-C standards for UTP and optical fiber installation and testing procedures
   7. NEXT, signal attenuation, and noise burst test procedures for UTP
   8. Power metering of fiber optic cables
   9. Industry and manufacturer's installation, testing instructions and verification documentation for all other products specified in this document

J. Work shall conform to all Owner, OSHA, State, job site, and labor requirements.

K. All trade contractors must follow all rules of the job site specified by the Owner and by the project's General Contractor.

L. All work must be completed in a timely fashion following the published start and completion dates.

M. Coordinate construction schedule with the Owner and General Contractor before beginning installation.

N. Ensure preceding trade's work is accurate before proceeding with the technology infrastructure installation. Examples of work which must be verified and approved, in writing include, but are not limited to:
   1. Electrical requirements (conduit installation and capacity, power receptacle location and type, grounding system, and pull strings by other trade contractors).
   2. Telecommunications rooms sizes and verification they have been constructed to the size shown on the project drawings.
   3. Adequate clearances of doors, riser spaces, vertical dimensions and ceilings.

O. Stage the installation equipment in dedicated telecommunications space to avoid damage and interference with other trades.

3.02 INSTALLATION

A. All materials shall be firmly secured in place per the manufacturer's installation guidelines unless requirements of portability dictate otherwise in the project documents.

B. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three times. Requirements for Zone 4 seismic bracing and earthquake safety shall be met at all times.

C. All boxes, equipment, materials, outlet housing, etc., shall be secured, plumb and square unless otherwise indicated by the project documents and/or the manufacturer's installation instructions.

D. In the installation of equipment and cable, consideration shall be given not only to operational efficiency, but also to overall aesthetic factors.

E. Protective covers normally shipped with the connector shall remain over the connector after installation. The cover shall be held in place with electrical tape or plastic tie-wraps if there is any chance of it being dislodged during construction and move-in.

F. Any connector (including all hardware) that is not normally shipped with a protective cover shall be covered with a clear non-conductive medium, such as heat-shrink or plastic wrap, to protect against dust, paint and moisture. Protective covering shall not cover cable or station identification.

G. Leave nylon pull strings in all conduits and pathways for future installations. The nylon pull string must have a minimum tensile rating of 200-pounds.

3.03 COPPER CABLE

A. Install all copper cable per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA-568-C, and in counts indicated on the project drawings.

B. Install all cables with proper attention paid to bend radii, pulling method, attachment method, and pulling forces. The cable manufacturer's specifications for each particular cable type shall be followed exactly unless otherwise indicated on the project drawings.

C. Install the copper cable in groups according to quantities listed on the project drawings.

D. All cable shall be pulled using an appropriate measuring device to ensure that the specified force is not exceeded.

E. All cable shall be visually inspected for insufficient bend radius during and after pulling. Damaged cables, or those installed under questionable methods and/or circumstances shall be replaced at no additional cost to the Owner.

F. All cables shall be clearly labeled on both ends and in an accessible location no more than two-feet from the cable ends.

3.04 OPTICAL FIBER CABLE

A. Install all optical fiber cable per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA-568-C, and in counts indicated on the project drawings.

B. Install all cables with proper attention paid to bend radii, pulling method, attachment method, and pulling forces. The cable manufacturer's specifications for each particular cable type shall be followed exactly unless otherwise indicated on the project drawings. All cable shall be pulled using an appropriate measuring device to ensure that the specified force is not exceeded.

C. Install the optical fiber cable in groups according to quantities listed on the project drawings.

D. A minimum of six feet of each optical fiber strand shall be left protected within the termination shelf for any future re-termination of a particular optical fiber strand.

E. All cable shall be visually inspected for insufficient bend radius during and after pulling. Damaged cables, or those installed under questionable methods and/or circumstances shall be replaced at no additional cost to the Owner.

F. All optical fiber cable shall be securely fastened to the termination shelf in a way that does not damage the optical fiber strands or impede the performance of the media. This secure fastening method shall also serve to insure a secure termination environment.

G. All cables shall be clearly labeled on both ends and in an accessible location no more than two-feet from each cable end.

3.05 UNIVERSAL HORIZONTAL STATION CABLE

A. All horizontal UTP cabling will be universal in nature and should be installed as such.

B. Install all universal horizontal station cable per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA-568-C, and in counts indicated on the project drawings.

C. Install all cables with proper attention paid to bend radii, pulling method, attachment method, and pulling forces. The cable manufacturer's specifications for each particular cable type shall be followed exactly unless otherwise indicated on the project drawings. All cable shall be pulled using an appropriate measuring device to ensure that the specified force is not exceeded.

D. All cable shall be visually inspected for insufficient bend radius during and after pulling. Damaged cables, or those installed under questionable methods and/or circumstances shall be replaced at no additional cost to the Owner.

E. All universal horizontal station cable shall be securely fastened to the termination shelf and at the station end in a way that does not damage the individual copper conductors or impede the performance of the media. This secure fastening method shall also serve to insure a secure termination environment.

F. All cables shall be clearly labeled on both ends and in an accessible location no more than two-feet from each cable end.

3.06 PATHWAYS AND CABLE SUPPORT

A. The electrical contractor shall install conduit systems and outlet boxes outside of the telecommunication rooms as called for by the project documentation.

B. All cable transport systems outside of the telecommunication rooms excepting conduit systems and outlet boxes shall be provided by The Contractor.

C. All cable transport systems within the telecommunication rooms shall be provided by the Contractor.

D. Draping cables over other structures in the ceiling is unacceptable. Water pipes, ceiling grid, sprinkler system, electrical supports, air ducts or any other in-ceiling structure may not be used for cable support.

E. Cable must be routed to follow existing corridors and parallel or ninety (90) degree angles from all walls and the cable tray.

3.07 TECHNOLOGY OUTLET HOUSING AND TERMINATION COMPONENTS

A. The Owner reserves the right to specify a new location for any technology outlet without increasing contract cost - providing that the new location is specified prior to roughing-in and is not farther than ten (10) feet away from the original location specified.

B. Install all technology outlet housing and termination component per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA-568-C, and in counts indicated on the project drawings.

C. All technology outlets located on a wall shall be flush mounted, level and plumb. All technology outlets shall be mounted at right angles and parallel to the floor.

D. The Owner, prior to installation by the Contractor, must confirm furniture termination locations and faceplates.

E. Install blank inserts in spaces within the faceplates that are not being filled with cable connection ports.

F. Mount all outlets at building standard outlet height, unless noted otherwise on the project drawings.

G. All faceplates, as well as each individual utilized port, must be labeled in accordance with an Owner-approved labeling scheme.

H. Terminate all technology outlet jacks and modules per the manufacturer's recommended installation instructions, under the guidelines of TIA/EIA-568-C, and in counts indicated on the project drawings.

I. Specific attention shall be paid to the length of UTP cable jacket stripping so that it does not exceed 0.5-inch from the termination point within the outlet jack.

3.09 CABLE MANAGEMENT

A. Install all vertical and horizontal cable management per the manufacturer's recommended installation instructions, as indicated on the project drawings.

B. When dressing the cables, the top 24 ports shall route up into the horizontal cable manager above the patch panel, and the bottom 24 ports shall route down into the horizontal cable manager below the patch panel.

C. All cable bundles inside the telecommunications rooms shall be secured with Velcro cable wraps.

D. Cable ties and Velcro cable wraps shall not be pulled tight enough to kink the cable jacket.

E. The maximum amount of cables per bundle in the telecommunications rooms is 24.

3.10 RELAY RACKS

A. Install all relay racks per the manufacturer's recommended instructions for a Zone 4 installation, as indicated on the project drawings.

B. Provide two-post and/or four-post open frame racks as indicated on the project drawings.

C. Anchor all racks to the concrete floor and cable runway system above for support bracing.

D. Label the top and bottom of all relay racks and cabinets as indicated on the project drawings.

3.11 GROUNDING

A. All grounding shall be in accordance with the National Electrical Code and TIA/EIA-607.

B. The Contractor is responsible for providing and installing all ground wire to every rack, cabinet, runway, cable tray, etc. from grounding busbars (installed by others).

C. All non-active equipment in the telecommunications rooms must be grounded to the local busbar by an individual ground wire. Active equipment shall be grounded through the electrical system.

D. Install the connecting ground wire in a star topology deriving from the main telecommunications ground bar within each IT/telecom room. Daisy-chaining ground wire is unacceptable.

E. All telecommunications grounding and bonding from busbars to racks or cabinets shall comply with all applicable laws, regulations, standards and codes and any applicable amendments.

F. Ground wire must be solid conductor or braided and in sheath(s). Stranded wire may not be used. Bare wire may not be used.

G. Total DC resistance to ground must not exceed 1 ohm.

H. At a minimum, Contractor shall use grounding conductors in accordance with the following table:

Distance (feet)	Wire Size (AWG)
Up to 100	6
101-160	4
161-250	2
251-350	1
351-400	0
401-500	00

I. Gas and water pipes shall NOT be used as a grounding electrode.

J. All bonds shall be suitably protected against corrosive atmospheres, vibration and/or mechanical damage.

K. Each bonded joint shall be protected against corrosion by assuring that the metals to be bonded are galvanically compatible. Bonds shall be protected from vibration-induced deterioration by assuring that bolts and screws are adequately torqued.

L. Compression bonds between copper conductors or between compatible aluminum alloys shall be located in easily accessible areas not subject to weather exposure, corrosive fumes or excessive dust and shall not require sealing.

M. Any power strips provided in equipment cabinets and/or racks must be grounded to the electrical ground system.

3.12 FIRE STOPPING

A. General:
1. Install all fire stopping material associated with the telecommunications transport system with methods that comply with all applicable laws, regulations, standards, and codes.
2. Install all fire stopping material to be compliant with installed sleeve details.

B. Fire stopping requirements:
1. Seal all penetrations for rigid conduit or sleeves using approved materials installed according to the manufacturer's sections and local codes.
2. All slot or chase-type penetrations placed at time of casting shall be fire stopped.
3. All individual cable or wire penetrations that are not in conduit shall be fire stopped.
4. Penetrations in gypsum board wall for cable trays shall be boxed-out with gypsum board and sealed with a design-tested fire stopping system installed per the manufacturer's sections and instructions.
5. All metal conduits/sleeves identified as serving the possible purpose of routing voice and data cabling, with or without wire and/or cable inside shall be fire stopped.

3.13 LABELING

A. Install all labeling to comply with TIA/EIA-606 standard for labeling and administration of cable plants that is also consistent with the Owner’s guidelines. Contractor shall confirm cable plant labeling system with Owner and Owner’s representative, in writing, prior to installation as part of the submittal process.

B. Each cable must be machine labeled on both ends and at all locations where the cable is accessible for administration.

C. Each outlet shall be given a unique number outlined in a labeling scheme provided by the Owner. The labeling scheme will be prepared under the guidelines of TIA/EIA-606 standards for labeling and administration. The Contractor is responsible for utilizing the Owner's approved labeling scheme throughout the Work.

D. Label each patch panel port with the same color and number of corresponding outlet as designated in the Owner's labeling scheme. Label each port on the technology outlet with a machine labeled port designation.

E. Label cables with the number of pairs or fibers and the location of terminations. Use full wording for the names of termination points. Labels that refer to room numbers only are unacceptable and will be replaced at no additional cost to the Owner.

F. Label the MDTR, BDTR and FDTR backbone voice fields with pair numbers. Begin with 0001 and work forward when designating a copper backbone cable, unless otherwise directed by the Owner. Label the FDTR station fields with unique technology port identifiers, as indicated in the Owner's labeling scheme.

3.14 TESTING

A. The Contractor shall be responsible for all testing and performance parameters required by this section and all applicable TIA/EIA-568-C series standards.

B. Furnish all equipment and personnel to conduct these tests in accordance with the performance section requirements.

C. Prepare Test Reports Manual as described in this section documenting the results of these tests and readings.

D. Test results must be submitted to the Owner as part of the project documentation prior to acceptance as required by this section.

E. Testing of copper wiring shall be performed prior to system cutover (100 percent of the horizontal and riser wiring pairs shall be tested for opens, shorts, polarity reversals, transposition and presence of AC voltage).

F. Any pairs not meeting the requirements of the standards shall be brought into compliance by the Contractor, at no charge to the Owner.

G. Category-6A data cable test procedures must comply with and meet the following standards:
1. TIA/EIA-568-C
2. NEMA Low Loss extended frequency requirements
3. Any additional Owner standards attached to general conditions

H. Complete four pair testing must be performed with full sweep frequency measurements from 1 MHz to 500 MHz, and the Power Sum Far End Cross-Talk test. This test will establish each channel's installed performance measurement. This is not a certification or compliance test, rather a measure of available headroom. Any copper cable failing to meet the above-indicated standards must be removed and replaced, at no cost to the Owner, with copper cable that proves in testing to meet the standards.

I. Test all Category-6A cables with a third party approved tester noted above. The testing device must be provided by the Contractor and approved by the Owner's representative prior to use. It is the responsibility of the Contractor to get written authorization from the Owner's representative to commence testing with said device.

J. All cables are to be tested for:
1. Continuity
2. Polarity
3. Insertion Loss
4. Length

K. Test procedure - Category-6A cables
1. All CAT-6A cables shall comply, must be tested, and meet the following TIA/EIA-568-C standards:
a. Insertion Loss
b. Near End Cross talk (NEXT)
c. Power Sum Near-End Cross talk (PSNEXT)
d. Attenuation to Crosstalk Ratio – Near End (ACRN)
e. Power Sum Attenuation to Crosstalk Ratio – Near End (PSACR-N)
f. Far End Crosstalk (FEXT)
g. Power Sum Attenuation to Crosstalk Ratio – Far End (PSACRF)
h. Return Loss (RL)
i. Wire Map
j. Propagation Delay
k. Delay Skew
l. Length

L. Test procedure - fiber data cabling:
1. All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices. Testing shall consist of a bi-directional end-to-end power meter test performed per TIA/EIA-568-C. The Contractor shall test all fiber cable prior to the installation of the cable. The Contractor shall assume all liability for the replacement of the cable should it be found defective at a later date.
2. Loss budget:
a. Fiber links shall have a maximum loss of: (allowable cable loss per km)(km of fiber in link) + (.4dB)(number of connectors) = maximum allowable loss.
b. A mated connector-to-connector interface is defined as a single connector for the purpose of this section.
c. Loss numbers for the installed link shall be calculated by taking the sum of the bi-directional measurements and dividing that sum by two.
3. Any link not meeting the requirements of the standard shall be brought into compliance by the Contractor, at no charge to the Owner.
4. Optical fiber splices, fusion or mechanical, shall not exceed a maximum optical attenuation of 0.3dB when measured in accordance with ANSI/TIA/EIA--455-34, Method A (factory testing) or ANSI/TIA/EIA--455-59 (field testing).
5. The testing of all Fiber optic cables must include tests using an Optical Time Domain Reflectometer (OTDR) or other Owner and Owner representative-approved test equipment. Documentation of the signature trace of the cable must include each of the following:
a. Attenuation per kilometer
b. Total length of each strand
c. The length of the longest cable run from each closet must be recorded and entered into the projects cabling database
6. The test results must include the loss generated by each connector. Loss should be stated in dB. No fiber optic link will be accepted with a loss greater than 2dB.

7. Insertion Loss testing must be done using hand held units for the source and meter. Acceptance tests for all fiber strands shall include attenuation, attenuation uniformity, and end-to-end integrity. The Contractor is to ensure that losses are within budget levels. These tests shall be accomplished and documented using loss sets at the desired wavelength of 1300 and 850 NM. The loss test should be performed after all splicing, connectorization and interconnection has been completed. Loss tests should be zeroed using the test lead to be used making the measurements.

3.15 TESTING AND DOCUMENTATION

A. A complete set of test results must be presented to the Owner and the Owner's representative at least one week before the placement of active electronics in all Owner IT/telecom rooms. The Contractor shall identify the types of cable testers used during the testing and verification when presenting the results.

3.16 SYSTEM ACCEPTANCE

A. Provide a statement of completion certifying that the system is installed and is ready for initial review, demonstration that the system is operational and functional, and ready for owner testing.

B. Schedule a time for the Designer and Owner to perform the validation walkthrough and owner testing with at least 14 days advance notice.

C. Qualification for acceptance: Subsequent to completing the validation walkthrough and Owner testing, Contractor shall furnish the Owner/Designer with copies of initial project close out documentation as required in this section.

D. Furnish all equipment and personnel to conduct spot tests as directed by the owner of the performance requirements outlined in this section, these tests will be completed in accordance with the performance section requirements.

E. The installation will not be accepted by the Owner until all work, including training, documentation, and all punch list items are remedied to the Owner's satisfaction.

F. The project manager must be available to answer questions about the installation and to attend site visits and meetings during the acceptance period.

G. If the system does not meet criteria or if additional trips to the JOB SITE for testing or adjustment are required, the Contractor shall reimburse the Owner for all expenses and professional time encountered by the Design Consultant/Architect.

3.17 CLEANUP AND REPAIR

A. The Contractor shall perform a daily cleanup of the installation site removing all debris created as a direct result of the installation of the voice data communication system.

B. Remove all debris and repair any damage caused to the premises by installation activities.

C. Upon completion of an installation task, the relevant areas and equipment shall be left clean and in an operational state.

3.18 TRAINING

A. Provide four, non-contiguous, four-hour , (16 total hours) of post-installation training sessions by a suitably qualified instructor, to personnel designated by the Owner in the operation and maintenance of the installed cable plant.

END OF SECTION 27 10 00

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SECTION 27 41 16

AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.01 REQUIREMENTS

Contractor shall review all other documents for additional requirements and information that apply to the Work. If conflicts between this Section and/or the General Requirements and General Conditions occur, the more stringent shall apply. Contractor shall deliver the complete Audiovisual System, including any design-build requirements of this Section and the following Drawings:

TA.0.01	Sheet Index and Notes
TA.1.01A	AV Floor Plan – Area A
TA.1.01B	AV Floor Plan – Area B
TA.2.01A	AV Reflected Ceiling Plan – Area A
TA.2.01B	AV Reflected Ceiling Plan – Area B
TA.4.01	Audio Functional
TA.3.01	Sections and Elevations
TA.5.01	Rack Elevations and Details
TA.7.01	Coordination Details

1.02 PROJECT DESCRIPTION

A. Overview - The gymnatorium, cafeteria, classroom, conference room, and lobby audio visual systems will support general education events. The building MDF will contain the main equipment rack. The main equipment rack will have a simple zone selectable volume control.

B. Gymnatorium
   1. Loudspeaker Systems: There are four sets of loudspeaker systems supporting the gymnatorium.
      a. Three sets of ceiling mounted pendant speakers aimed downwards.
      b. One set of ceiling mounted loudspeakers aimed at the bleacher seating.
   2. Microphone Input: There are two XLR microphone input jacks located on the north as well as two at the south wall of the gymnatorium.
   3. Control: There are volume control knobs with feedback located on the north as well as the south wall, next to the microphone inputs, within the gymnatorium. The user interface for the audio systems will be button panels. The button panels are to be simple to use and descriptive in nature.

C. Cafeteria
   1. Loudspeaker Systems: There are three sets of loudspeaker systems supporting the cafeteria.
      a. Three sets of ceiling mounted pendant speakers aimed downwards.
   2. Microphone Input: There are two XLR microphone input jacks located on the west wall of the cafeteria.
   3. Control: There are volume control knobs with feedback located on the west wall, next to the microphone inputs, within the gymnatorium. The user interface for the audio systems will be button panels. The button panels are to be simple to use and descriptive in nature.

D. Classroom
1. See Section 27 10 00 – Communication Systems for information about the classroom audio visual systems.

E. Conference Room
1. A display will be wall mounted with connectivity within a floor box located under the main conference room desk.

F. Office Lobby
1. A display of live IP security camera feed will be wall mounted in the upper corner of the room.

1.03 SCOPE OF WORK

A. Contractor shall provide a turn-key audiovisual system installation including, but not limited to, all cabling, loudspeakers, projection & display equipment, mounting hardware and electrical components including the necessary equipment, interconnections, transducers, labor, and services required to meet the functional requirement outlined in the design documents.

B. The Contractor will be held responsible to have examined the site and premises and satisfied them self as to existing conditions under which they will be obligated to operate in performing their part of the work or that, which will in any manner affect the work under this contract.

C. Permits: Obtain any necessary permits for the execution of this work in conformance with applicable union regulations, local, State and Federal codes and regulations.

D. All aesthetic issues are to be coordinated and approved by the Owner, Architect, and Design Consultant.

E. Provide size, and install all conduit and penetrations, wire raceways, back boxes, and cabling connecting system components as required by the Audiovisual System, not installed by the General Contractor.

F. Verify all conduit and penetrations, wire raceways, back boxes, mounting hardware to building structure, and cabling connecting system components, as required by the Audiovisual System and installed by the General Contractor/Electrical Contractor as part of the base building fit out. Notify Owner of any discrepancies that may exist between the Shell Contract Documents and existing conditions.

G. Verify AC power requirements for each equipment location. Notify Owner of any discrepancies that may exist between Shell Contract Documents and existing conditions.

H. Patch, repair, finish and paint any surfaces that are damaged or demolished for access during this work. Room finishes to be returned to initial condition.

I. Coordinate the resolution of any audiovisual system issues including, but not limited to, architectural and structural items associated with the project.

J. Coordinate with other trades to ensure that all required access and clearances to equipment and services are provided and maintained.

K. Verify site conditions including dimensions and clearances. Coordinate and size the exact location of the equipment racks with the architectural drawings.

L. Conduct preliminary testing and adjustment. Submit documentation required by this Specification. Participate in approval testing for acceptance by the Owner. Perform final adjustments as required to meet the Specifications.

M. Deliver to the Owner, bound "as-built" system documentation. Transfer all warranties and equipment guarantees to the Owner and provide a written description of system operation at the time of acceptance of the Work by the Architect/Owner.

N. Provide system operation training as specified in Part 3 of this Section.

1.04 QUALITY ASSURANCE

A. All materials must be newly manufactured current production models and conform to all applicable codes and the relevant standards listed below:
   1. American National Standards Institute (ANSI)
   2. Electronic Industries Alliance (EIA)
   3. Institute of Electrical and Electronic Engineers (IEEE)

B. Experience: The Contractor shall specialize in the installation of audiovisual systems, have a minimum of five years of documented experience in the field of audiovisual system installation and be a manufacturer approved vendor for all of the components installed.

C. Supervision: Contractor shall designate a Project Manager and Foreman to oversee the installation work for the duration of the Work, to ensure that the system is installed in accordance with the Specification and Drawings.
   1. Project Manager shall maintain adequate staff and be responsible for installing and testing the system on schedule.

   2. Project Manager and Foreman/Project Supervisor shall have at least five years of documented, recent and similar project experience.

D. The Owner reserves the right to make use of the system prior to the completion of the Work. Temporary use of the equipment shall not constitute an acceptance of the system or any part. The Owner shall not pay additional cost to the Contractor and the commencement of the warranty period shall not begin for the system, or any device, prior to the completion of the punch list and final acceptance of the system by the Owner.

E. Contractor shall promptly notify the Owner, in writing, of any site difficulties that may prevent proper coordination or timely completion of the Work. Failure to do so shall constitute acceptance of Work and indicate that the site is suitable in all ways for this Work, except for defects that may develop in the work of others after commencement of system installation.

F. Insurance: Provide evidence of insurance for the full value of equipment and material located on-site. Insurance shall cover losses due to fire, theft and vandalism, until the final acceptance of the system, by the Owner. Maintain additional liability insurance to protect the supplier and/or Owner, Architect, Design Consultant against damage claims for personal injury, including death, which may arise during the performance of this work.

G. The Lead Control System and Audio/Video Digital Processing Programmers in the office and in the field shall be certified as defined by the manufacturer of the equipment in question.

1.05 REFERENCES

A. All requirements of the latest published edition, unless otherwise noted, shall apply.

B. National Electric Code (N.E.C.).

C. National Electric Safety Code (N.E.S.C.).

D. Davis, Don, Sound System Engineering, Second Edition, Howard W. Sams and Co., Indianapolis, Indiana, 1997.

E. American National Standards Institute (A.N.S.I.).

F. Electronics Industries Alliance (E.I.A.).

G. Audio - Design and Installation, Giddings, Howard W. Sams, 1990.

H. Society of Motion Picture and Television Engineers (S.M.P.T.E.).

I. American Society for Testing Materials (A.S.T.M.).

1.06 SUBMITTALS

A. Contractor shall comply with the General Requirements and General Conditions of this Specification.

B. Bid Submittals: Contractor shall submit the following qualification documents with the bid proposal:
1. Firm description of the Contractor, and a copy of the Contractor's license, as well as a statement regarding the relationship of the License Holder to the Contractor.
2. Provide a minimum of ten related projects, four of which must have been completed within the last 12 months.
3. Résumé of Project Manager and onsite Foreman/Project Supervisor documenting related experience. Foreman/Project Supervisor must have completed at least two similar installations in the past 12 months. Indicate any certifications held by the Project Manager and onsite Foreman/Project Supervisor such as PMP/CTS-I or other.
4. Project Manager and Foreman/Project Supervisor cannot be changed without approval of Owner.
5. Submit a list of major equipment components, along with any deviations, to the system design and Specification. Indicate which products will not be purchased directly from the manufacturer.
6. Submit a list including names, firm description, job foreman, copy of license and scope of work, for any subcontractors whose work would be part of this Contract.
7. Submit a list of names for the lead installers who will be working on this project and indicate for each, if they are NSCA NICET/EST or ICIA CTS-Install, certified or registered.

C. Construction Submittals
1. Provide shop drawings and record drawings using the following scales:

a. Plans - not less than 1/8" = 1'-0"
b. Details - not less than 1/4" = 1'-0"

2. Before ordering equipment, submit catalog data sheets, neatly bound with a title page, space for submittal stamps and tabbed dividers between sections. List all proposed equipment with reference to corresponding specification paragraph numbers or equipment title. Denote all approved substitutions. Data sheets may also be delivered in a single flattened PDF format file if physical delivery is not practical.
3. Submit point-to-point wiring diagrams and typed wire lists identifying every connection. Include electronic devices such as switches, transformers and terminal blocks. Indicate location of all components. Identify cables by types, colors and wire numbers.
4. Submit system plans showing all device locations.
5. Submit reflected ceiling plans showing distributed loudspeaker layouts with wattage tap settings, projection systems, cameras and other ceiling mounted devices.
6. Submit conduit riser diagrams showing connection of all devices along with types and quantities of cables to be used and cable identification tags.
7. Submit rack layouts indicating the proposed arrangement of mounted equipment including junction boxes and locations of conduit penetrations.
8. Submit fully dimensioned construction details of all panels, plates and other custom fabricated items or modifications (e.g. installation of audio/visual equipment in lecterns). Include complete parts lists and, as required, schematic diagrams.
9. Submit fully dimensioned construction details of all coordination items, such as panel or plate installation in casework or millwork as needed to complete the Work.
10. Submit a schedule of finishes indicating proposed materials and color selections for all exposed items subject to Architect's approval.
11. Submit samples of engraved labels, cable-marking system, faceplate etching/finishes and loudspeaker grilles.
12. Submit mounting and support details for distributed ceiling loudspeakers, video projectors and all other items mounted overhead, complete with parts lists and dimensions. Include a full plan view, front elevation and side elevation of each item, with corresponding support structure and mounting hardware. Verify load ratings of all hanging components including attachment hardware. A structural engineer registered in the State shall stamp details.
13. Submit a list showing coordination of selected frequencies for all wireless transmitters.
14. Submit an Excel list showing all equipment requiring data connections. At a minimum identify the following fields, Location, Description, MAC address, Jack number, IP Address, Subnet Mask, Gateway, DNS. Submit list with first three items completed for submittal review, include jack number as well if available. Include items on client LAN as well as AV LAN. Once approved, provide client LAN list to owner's networking group to obtain IP information. Maintain list throughout project and provide final list with as-built documents.
15. Before final control system program installation, submit interactive demonstrations of all control system touch panel pages as well as an electronic copy of the pages as required by Part 2 of this Section.

D. Acceptance Test Submittals: Prior to requesting the completion of the acceptance tests, submit Preliminary Test Report Information required in Part 3 of this Section.

1.07 PROJECT CLOSE OUT

A. General
1. Furnish one initial set of Project Close Out Documents including but not limited to manuals, record drawings along with the results of all source quality control tests, and field quality control tests specified in Part 3 of this Section, to the Design Consultant, for use during acceptance testing.
2. If 'as installed' documents are rejected, correct and resubmit in the manner specified.
3. One set of B size drawings showing the components and wiring in each individual rack shall be mounted in a plastic jacket to the rear door of the associated rack.
4. After approval of 'as installed' documents, submit sets of record drawings as follows:
   a. One set of full size prints
   b. One set of reduced B size prints
   c. One set of manuals
   d. Four electronic submittals on CD-ROM/DVD disk(s).
5. At the time of contract closeout, submit sets of the system Operation Manual and the Maintenance Data Manual as follows:
   a. One set hardcopy for owner.
   b. Four sets electronic on CD-ROM/DVD disk(s).

B. Manuals
1. Neatly bind each manual with tabbed dividers between sections, include title page between sections, binder title covers and spines.
2. Manuals shall be presented in 3 ring – D style binders.
3. The Manuals shall be broken down into the following minimum sections:
4. Operations Manual
   a. Table of Contents
   b. Typed description of each system including key features and operational concepts (e.g. remote control features, switching or routing functions, patch points, mixing and linking capabilities).
   c. Setup diagrams and typed instructions for use in typical situations as directed by the Design Consultant.
   d. Single-line block diagrams showing all major system components.
   e. One set of B size drawings showing the components and wiring in each individual rack.
   f. Manufacturer's operation manuals for equipment intended for operation by system users (e.g. source equipment, communication equipment, etc).
5. Maintenance Data Manual
   a. Table of Contents
   b. Company name, address, telephone number and contact name for system service or maintenance.
   c. Listing of all equipment and materials with names of manufacturers and model numbers or part numbers.
   d. Catalog data sheets displaying manufacturer's names, addresses and telephone numbers.
   e. Product manufacturer's warranties and a typed, one-year system warranty, explicitly covering all materials and labor.
   f. Manufacturer's service manuals for all major equipment items.

g. Test documentation showing results of source quality control tests, field quality control tests, acceptance testing and equalization. Document final settings for all non-user devices and controls after completion of acceptance testing and equalization, including raw and equalized house curves. Document the physical position of settings as well as input and output signal levels as required by Part 3 of this Section.

h. Provide a recommended preventative maintenance schedule for reference to the applicable pages in the manufacturer's maintenance manuals. Where the manufacturer provides inadequate information, develop and provide the information necessary for proper maintenance.

C. Software

1. A properly licensed working copy of any and all software required to operate or configure the systems specified herein, shall be a part of the system supplied, including all software, firmware and hardware required for configuration, adjustment, diagnosis and repair.
2. All software shall be fully documented, and that documentation included.
3. Software shall be included in its 'installable' state on industry standard, CD-ROM/DVD, or other appropriate format from the manufacturer. Where possible a single master CD-ROM/DVD should be provided. If files are too large, break segments into logical sections, CD-ROM/DVD disk images are unacceptable.
4. Where any elements of the software are based on user modifiable source code, both the source code and the compiler shall be provided and documented as stated herein.
   a. The source code is to be licensed to the Owner for this project; the contractor maintains the copyright of the source code.
   b. The Owner has the right to modify the source code.
   c. If the source code is modified the Owner takes full responsibly for the effects caused by the modification to the source code.

D. Electronic Submittal: In addition to the above listed hard copy submittals, submit all files necessary to produce the above submittals as follows:

1. Submit the following on CD-ROM/DVD media.
   a. Files use long windows names file structure.
   b. A Disk Master File List in text format shall be placed on the CD-ROM/DVD with a short description of files on that disk.
2. Drawings shall be in AutoCAD r2000 or later drawing (.DWG) format. Drawing Exchange File Format (.DXF) shall not be acceptable. All XREFs, fonts, and other drawing parts necessary to the drawings shall be included.
3. Documents and spreadsheets shall be in Microsoft Office .docx/.xlsx format.
4. All files to be converted to searchable acrobat *.PDF files in addition to the native drawing, documents and spreadsheets formats.
5 Manufacturers' service manuals provided by the Manufacturer to the Contractor or documents that are similarly, not otherwise available to the Contractor in electronic format shall be excluded from this requirement.
6. Provide all control system source files and compilers on the same CD-ROM/DVD media. This should include, but is not limited to, touch panel files, IR code files, DSP configuration files, web-based touch panel pages, or any other files or applications necessary to completely reinstall and configure all system components back to their operable state.

E. Keys: Submit five sets of all keys required for access to and operation of the systems.

1.08 GUARANTEES AND WARRANTIES

A. Transfer all manufacturer and subcontractor's warranties to the Owner at the completion of all Work.

B. Guarantee all installation work to be free of faulty system-wide workmanship. Guarantee all new components purchased under this Contract and workmanship to be free from defects for a period of 12 months from the final date of acceptance, by the Owner, including solid-state devices.

C. Guarantee a response window of 2 hours for call-back phone support upon notification from the owner of a system operational issue during the warranty period.

D. Guarantee the on-site replacement of faulty materials and workmanship within 24 hours of notification at no cost to the Owner if failure occurs during warranty period. Provide loaner equipment as required to keep the system operational if the system cannot be repaired within 24 hours of notification.

E. Register warranty in the Owner's name for any product with a manufacturer's warranty of more than one year.

1.09 OWNER FURNISHED EQUIPMENT

A. Certain equipment may be identified as Owner Furnished Equipment (OFE). This OFE may presently be part of the Owner's systems or will be provided by the Owner, and will be delivered to the Contractor's off-site construction facility, delivered to the Contractor's on-site secured storage area or installed on site by others, as appropriate, for incorporation into the system.

B. Clean and inspect the OFE, and notify the Owner in writing of damage or defect and the extent of repair and/or adjustment required to bring the OFE to original specification. Service OFE only as directed by the Owner under the arrangements of a separate contract.

C. Incorporate into the system as if provided new, excepting warranty coverage.

1.10 MAINTENANCE

With the bid, submit an annually renewable service and maintenance proposal for a total of two additional years meeting the same conditions for service and repair as required for the initial one-year warranty. If accepted, the service and maintenance proposal shall commence upon conclusion of the one-year system warranty.

PART 2 - PRODUCTS

2.01 GENERAL

A. Components are to operate on standard US voltage outlets. Rack mounted equipment is to be mounted in a standard EIA 19-inch wide rack. The components listed in the equipment schedule are the basis of the audiovisual system design and represent the minimum standards for each of the components. All of the properties of each component or system should be considered listed in full.

B. Equipment, excepting the Owner Furnished Equipment (OFE), and materials shall be new. The latest version at time of delivery and shall conform to applicable UL, CSA, or ANSI provisions. Take care during installation to prevent scratches, dents, chips, etc.; equipment with significant or disfiguring cosmetic flaws will be rejected.

2.02 CABLE

A. General
1. Conductor jackets shall be color-coded to enable consistent polarity.
2. Use plenum rated cable where required by code.
3. Cables noted are referenced for minimum level of quality.
4. Use outdoor rated cables where required. Size may vary depending on distance requirements.
5. Acceptable Manufacturers: West Penn, Canare, Belden, Extron, Covid, Gepco, and Liberty.

B. Audio Cables
1. Microphone: Shielded, stranded 20 AWG, twisted-pair cable (West Penn 292)
2. Line Level Cable: Shielded, stranded 20 AWG, twisted-pair cable (West Penn 292)
3. Program Loudspeaker Cable: Stranded, twisted-pair 12 AWG cable (West Penn 227)
4. Distributed Loudspeaker Cable: Stranded, twisted-pair 16 AWG cable (West Penn 225)
5. UHF Wireless Antenna Cable: 50 ohm, (RG-58) coaxial cable (RG-58) (Belden 8259)
6. Digital Audio Transport Cable: 4 pair Category 6 Solid Twisted Pair cable, 24 AWG. (West Penn 4246)

C. Video Cables
1. MATV Drop Cable: 75 ohm RG 6U co-axial cable (West Penn 256350)
2. MATV Trunk Cable: 75 ohm RG 11U co-axial cable (West Penn 25811)
3. High Resolution Cable DVI (Single-link): 100-ohm multiple conductor cable in one jacket (Extron DVID SL Pro Series)
4. High Resolution Cable DVI (Dual-link): 100-ohm multiple conductor cable in one jacket (Extron DVID DL Pro Series)
5. High Resolution Cable HDMI: 100-ohm multiple conductor cable in one jacket, 18Gbps data rate (Extron HDMI Pro/Ultra Series)
6. Digital Media Transport Cable: 4 pair Category 6A (S)F/UTP cable, 24 AWG, 500MHz bandwidth. (Belden 10Gx series/Extron XTP DTP-24)
7. HDMI Bulk Cable: 100-ohm multiple conductor cable in one jacket, 28 AWG. (Covid LUX-HD-28RD)

D. Data / Control Cables
1. Control System Cable: 2 pair (18 AWG pair and 22 AWG pair) (Liberty AXLINK)
2. Data cable: 4 pair Category 6A F/UTP solid twisted pair cable. (West Penn 254246AF)
3. RS-485 cable: 7-conductor, 22 AWG cable. (Belden 9430)
4. RS-232 cable: 7-conductor, 22 AWG cable. (Belden 9430)
5. 5 pair, Stranded Twisted Pair Shielded, 24 AWG cable. (Belden 9807)
6. 9 pair, Stranded Twisted Pair Shielded, 24 AWG cable. (Belden 9809)
7. 12 pair, Stranded Twisted Pair Shielded, 24 AWG cable. (Belden 9812)
8. USB Revision 2.0 Compliant Bulk Cable: Two 24 AWG power conductors plus one 28 AWG twisted pair for data lines (L-com CBL-USB2-2824)

2.03 HARDWARE

A. Jacks, Connectors, and Adapters
1. Provide panel mounted isolated ground jacks.
2. Contacts are to be silver-plated, chromate dipped, phosphor bronze, or brass.
3. Install connector and jacks per manufacturer's directions.
4. Panel mounted jacks are to be recessed.
5. Acceptable Manufacturers: Canare, Switchcraft, Neutrik, Amphenol, Pomona, Extron, Covid, L-com, or Liberty.
6. HDMI Type A connector: 28 AWG DIY connector/clamshell for round cable (Covid LUX-DIY-28DS10).
7. USB Type A connector with hood: gold-plated solder contacts, nickel-plated steel shell, and UL94V-0 rated housing (L-com USBCN2.0-A, USBHD2.0-A).
8. USB Type B connector with hood: gold-plated solder contacts, nickel-plated steel shell, and UL94V-0 rated housing (L-com USBCN2.0-B, USBHD2.0-B).
9. Category 6A Shielded Keystone Style Jacks and plugs

B. Audiovisual System Face Plates: Provide metallic cover plates at all control, switching and jack locations. Etch and ink all system faceplates to indicate function, input/output number, etc. Minimum engraved letter height 1/8 inch. Coordinate finish with the Owner. Center lettering vertically OVER or horizontally to the right of the appropriate connector. Connector mounting shall allow sufficient finger clearance for connector insertion and removal without interference from adjacent connectors.

C. Electronic Component Face Plate Labels: Provide permanent labels as specified and shown on detail drawings. Engraved plastic labels fastened with epoxy are acceptable. Dymo type labels are not acceptable.

D. Provide a neatly labeled floor plan with as-built locations of all audiovisual jacks. Locate floor plan in front cover of the equipment rack behind a clear Plexiglass cover. Minimum size of chart: 8-1/2 inches x 11 inches.

E. Provide system functional description and operating procedures for each system configuration. Place behind clear Plexiglass near each of the equipment racks. Include basic operating procedures and troubleshooting steps.

F. Provide a 1-rack unit panel with Consultant's name and web address and Contractor's name, address and phone number in the main equipment rack of each system. Panel shall state: Designed by "Consultant" Installed by "Contractor".

2.06 CONTROL SYSTEM PROGRAMMING

A. Contractor shall provide all control panel and control system programming to make fully functional and working systems. System functional requirements shall be as described in these documents.

8. Common user commands should be accessible with no more than two button presses. Common commands would include source selection, display/projector power, volume, transport controls, or similar.

2.07 AUDIO DSP (Digital Signal Processing) PROGRAMMING

A. The Contractor will ensure that:
1. Each DSP block has a description of its function.
2. Each DSP block has fully labeled endpoint nodes
3. Each DSP block with control dialogs has each channel labeled

B. The values in the audio DSP box shall be set to allow the performance requirements outlined in this document to be met.

PART 3 - EXECUTION

3.01 GENERAL

The following is required for acceptance of the audiovisual system by the Owner:

A. Install complete and functioning audiovisual system.

B. Label equipment and cables corresponding to functional diagram.

C. Conduct adjustments and preliminary testing.

D. Report results of preliminary testing along with system documentation.

E. Participate in acceptance test and deliver final system and documentation.

F. Conduct any adjustments or re-testing required to meet the performance specifications.

G. Provide training to an individual(s) designated by the Owner/Architect/Consultant.

3.02 AUDIOVISUAL OPERATIONAL REQUIREMENTS

Care shall be taken to eliminate electro-magnetic radio frequency and electro-static interference; the system shall be free of audible hum, rattles, buzzing sounds, distortion and visible hum bars or distortion.

3.03 OWNER PERSONNEL TRAINING

A. As part of Work of this Section, provide a total of 2 hours of on-the-job training for personnel, designated by the Owner for instruction, in the proper operation and maintenance of the systems. This training shall take place after the installation is operational but before the acceptance testing, in (four) two-hour blocks.

B. Provide the additional eight hours of training in a minimum of two-hour blocks during the first year after the system has been accepted. These training sessions are at the request of the owner.

C. Provide one initial set of manuals for the system as described in this specification at the time of training for review and comment by the owner’s personnel.

3.04 PERFORMANCE SPECIFICATIONS

A. The sound pressure level spectrum from the distributed speaker system, in each 1/3 octave band shall be ±3 dB from 125 Hz to 10 kHz with 6 dB per octave roll off above 10 kHz and below 125 Hz. Total acoustical harmonic distortion shall not exceed 2% at sound levels of 85 dBC (1 kHz reference tone) at four feet above finish floor in the middle of the room.

B. The gain structure for all audio system components (mixer input to amplifier output) shall be adjusted to achieve the highest signal-to-noise ratio, 75 dB from 50 Hz to 15 kHz minimum.

C. The audio frequency response of the electronics system with equalizers bypassed shall vary less than ±1 dB from 50 Hz to 12 kHz.

D. The electronic system audio distortion shall be less than 0.5% at 1 kHz at the equipment's rated input signal level.

E. Control functions: Demonstrate that each of the controlled devices may be controlled either at the individual device or through the use of the remote control system and that all individual devices and combinations of devices may be utilized in the logical and common formats and that all systems are in proper working order.

3.05 CONTRACTOR'S TESTING AND ADJUSTMENTS

A. Furnish all equipment and personnel to conduct these tests in accordance with the performance specification requirements.

B. All timing and gain measurements shall be made while the operator controls of the device under test are set in the center-of-travel, in bypass, nulled out or at the manufacturer’s detent position. Any adjustments should be made by modification of cable length or internal adjustments.

C. Audio Testing
1. Before connecting high impedance (distributed) loudspeaker lines to the power amplifiers, measure and record the impedance curves of all loudspeaker circuits, using a sweep test or impedance bridge for at least six frequencies from 125 Hz through 8,000 Hz.
2. Test all low-level audio cables and connections for continuity and ground faults and correct polarity.
3. Apply a sine-wave sweep signal to each loudspeaker system, sweeping from 50 Hz to 5,000 Hz at a sound pressure level, which is 10 dB below the loudspeakers rated electrical input power. Listen for rattles or objectionable noise and correct if apparent.
4. Check for proper polarity of loudspeakers by applying music program or pink noise to each system and walking through the transition areas of coverage from one loudspeaker to the next. Transition should be smooth with no apparent shifting of source, back and forth from one loudspeaker to the next.
5. Coverage Uniformity: Scan the areas served by the system and record sound pressure level in 1/3-octave bands. Perform any necessary adjustments to loudspeaker orientations as required to achieve the specified uniformity.
6. Adjust all system gain controls, both physical and virtual in software, for optimum signal-to-noise ratio. After all adjustments required to meet the performance Specification requirements are made, measure and report the resulting system

electrical signal-to-noise ratio at the amplifier outputs from 20-20 kHz in 1/3 octave bands referenced to the voltage required to achieve 85 dBC in the center of the room (1 kHz reference tone) at 4-feet above finish floor.

7. Measure the sound pressure level using a calibrated type 1 precision sound level meter as defined by ANSI S1.4. Measure using the slow time Constant. Report the "raw house curve" with the equalizer controls set to "0." Adjust all gain controls and equalizers to provide the 1/3-octave band sound levels specified.

3.06 ACCEPTANCE TESTS

A. Provide a STATEMENT OF COMPLETION, certifying that the system is installed and is ready for acceptance testing by the Design Consultant.

B. Schedule a time for the Design Consultant to perform system acceptance testing and adjustment with at least 14 days advance notice.

C. Qualification for Acceptance: Subsequent to completing preliminary testing, Contractor shall furnish the Owner/Design Consultant with copies of As Built documentation as required in this Specification.

D. Furnish a technician who is familiar with the system to assist the Design Consultant during the acceptance testing and equalization for the duration it takes to complete the adjustments (regular time or overtime as required). A minimum of 24 hours as required to complete the adjustments.

E. Acceptance Test: The Owner and Design Consultant shall be present during the acceptance testing and require the assistance and cooperation of the Contractor.
   1. Each major component shall be demonstrated to function.
   2. Measurements: Electrical, optical and acoustical measurements may be performed at the discretion of the Owner and/or their representatives. The Design Consultant will supply acoustical measuring equipment. Such measurements may include sound pressure levels, uniformity of coverage, distortion, or other pertinent characteristics. Contractor shall provide equipment for performing any necessary electrical test or adjustments.
   3. Viewing and listening tests may include subjective tests by observers at any location in the facility.
   4. Operating tests may include use of any individual or combination of systems provided and from any control location.
   5. Each cable may be inspected for proper termination.
   6. Under the direction of the Design Consultant, adjust signal levels and loudspeaker aiming, as required, to achieve the uniform sound distribution required by this Specification.

F. Such tests may be performed on any piece of equipment or system. If any test shows the equipment or system is defective or does not comply with the Specifications, Contractor shall perform any remedies, at their expense, and pay the subsequent expenses of any re-testing required.

G. Contractor shall provide a final report, which will document the final equipment settings and adjusted levels and values.

H. If the system does not meet criteria or if additional trips to the JOB SITE for testing or adjustment are required, the Contractor shall reimburse the Owner for all expenses and professional time encountered by the Design Consultant/Architect.

PART 4 - BIDDING INSTRUCTIONS

4.01 GENERAL

A. This section provides the bid format for the project's audiovisual system. This bid form is to be completed in its entirety. Failure to provide information required by this document may be considered grounds for immediate disqualification.

B. The installation of the audiovisual system is based on the attached design documents that describe the design developed by Thorburn Associates.

C. All equipment substitutions must be equal to or better fully functional replacements of the specified items. This includes items such as rack mounting requirements, software operating requirements, functional features, maintenance features and warranty length. Any alternates must be approved in advance by the Designer and Owner.

4.02 BID FORM

Provide the following documentation with your bid:

A. Refer to bid submittal section 1.06 B for bid submittal requirements. Attach all required information.

B. Provide a schedule indicating the number of workdays to install the system after each major sign-off by the Owner (i.e., after the bid is awarded, how many days to submit shop drawings, how many days after approval of shop drawings prior to construction, etc.) through the end of the project. Schedule shall be broken down as required by bidding firm's policies.

C. Provide a copy of your standard contract for materials and installation services.

D. A statement indicating all equipment is readily available. If not, provide a recommended solution as an alternate.

E. Provide a bid for to install a complete and operational system. "Complete and operational" is defined as tested and adjusted per design documents.

F. Complete bid form information called out in parts of this specification.

G. Return one additional courtesy copy of the completed bid form and all required documentation to Thorburn Associates, 2500 Gateway Centre Blvd, Suite 800, Morrisville, NC 27560.

PART 5 - PRICING

5.01 BREAKDOWN

A. Provide Unit Cost for each item listed below.

B. Provide a list of other equipment and hardware required for a complete and working system.

C. Provide Total Line Cost for each item listed below based on quantity.

D. Provide the following line item and unit costs:
1. Total Equipment Cost
2. Engineering
   a. Lump Sum
   b. Hourly Rate
3. Shop Labor
   a. Lump Sum
   b. Hourly Rate
4. Field Labor
   a. Lump Sum
   b. Hourly Rate
5. Training
6. Manuals
7. Shipping
8. Taxes
9. Overhead
10. Profit
11. Total Installed Cost

Quantity	Description	Preferred Manufacturer	Preferred Model
Video			
1	32" Display	Planar	PXL3280W
1	50" Display	Planar	EP5014K
1	Fixed Wall Mount	Chief	LTM1U
1	Articulating Wall Mount	Chief	TS325TU
Audio			
2	Power Amplifier	Crown	Dci |300
1	DSP	Biamp	TesiraFORTÉ AI
3	Loudspeaker	Tannoy	AMS 8DC
27	Pendant Speaker	Tannoy	OCV 8
1	Wall Mounted Rack	Middle Atlantic	DWR-24-22
Control			
1	Volume Control w/ Zoning	Extron	EBP 108 D
4	Volume Control	Extron	EBP VC1 D
1	Controller	Extron	IPCP Pro 350

END OF SECTION 274116

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SECTION 280500

ELECTRONIC SAFETY AND SECURITY

PART 1 – GENERAL

1.01 REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Security contractor shall review all documents for additional requirements and information that apply to the Work. If conflicts between this section and/or the General Requirements and General Conditions occur, the more stringent shall apply. Security contractor shall deliver the complete communications system, including and design-build requirements of this Section and the following Drawings:

TS-001 Sheet Index and Notes
TS-100 Overall Floor Plans
TS-200 Overall Reflected Ceiling Plans
TS-701 Coordination Details

1.02 PROJECT DESCRIPTION

A. Section Includes: Provide new equipment for this project that will interface with the Owner's existing integrated electronic security system (IESS) according to the requirements defined in this section, and specific requirements defined in related sections and in the contract drawings.

B. This project involves making additions to currently operating systems. Great care must be exercised before making changes to the Owner's systems or programming.

C. The IT infrastructure and hardware required for all IT based security devices is to be supplied by the Owner's structured cabling contractor.

D. Owner furnished and installed items:
1. Access control system credentials.
   a. Test cards will be issued by Owner for contractor testing and verification.
2. Security workstation computers and monitors
3. Avigilon Video Management System software, licenses and recording/storage hardware
4. Network switches, including PoE ports as necessary

E. Security contractor furnished and installed items:
1. All equipment as required for a complete and fully functioning IESS.
   a. Card access readers to match existing devices in current space in locations specified per drawings
   b. Axis network cameras in locations specified per drawings
2. All security device cabling for connected field located security devices not serviced by provided network cables.
3. All IESS programming and provisioning of new devices on Owner's:
   a. Current access control system.
   b. Current Video Management System and all camera programming based on Owners requirements whether delineated in this document or not.

F. Alternate Work

1. All external cameras shown on drawings will be an alternate to the base system.

1.03 SCOPE OF WORK

A. Contractor shall provide a turn-key security system installation including, but not limited to, all cabling, cameras, mounting hardware and electrical components including the necessary equipment, interconnections, labor, and services required to meet the functional requirement outlined in the design documents.

B. The Contractor will be held responsible to have examined the site and premises and satisfied them self as to existing conditions under which they will be obligated to operate in performing their part of the work or that, which will in any manner affect the work under this contract.

C. Permits: Obtain any necessary permits for the execution of this work in conformance with applicable union regulations, local, State and Federal codes and regulations.

D. All aesthetic issues are to be coordinated and approved by the Owner, Architect, and Design Consultant.

E. Provide, size, and install all conduit and penetrations, wire raceways, back boxes, and cabling connecting system components, as required by the Security System, not installed by the General Contractor.

F. Verify all conduit and penetrations, wire raceways, back boxes, mounting hardware to building structure, and cabling connecting system components, as required by the Security System and installed by the General Contractor/Electrical Contractor as part of the base building fit out. Notify Owner of any discrepancies that may exist between the Contract Documents and existing conditions.

G. Verify AC power requirements for each equipment location. Notify Owner of any discrepancies that may exist between Contract Documents and existing conditions.

H. Patch, repair, finish and paint any surfaces that are damaged or demolished for access during this work. Room finishes to be returned to initial condition.

I. Coordinate the resolution of any audiovisual system issues including, but not limited to, architectural and structural items associated with the project.

J. Coordinate with other trades to ensure that all required access and clearances to equipment and services are provided and maintained.

K. Verify site conditions including dimensions and clearances. Coordinate and size the exact location of the equipment racks with the architectural drawings.

L. Conduct preliminary testing and adjustment. Submit documentation required by this Specification. Participate in approval testing for acceptance by the Owner. Perform final adjustments as required to meet the Specifications.

M. Deliver to the Owner, bound "as-built" system documentation. Transfer all warranties and equipment guarantees to the Owner and provide a written description of system operation at the time of acceptance of the Work by the Architect/Owner.

1.04 QUALITY ASSURANCE

A. Perform the work in accordance with current editions of all applicable local, municipal, and state codes and statutes listed below. In instances where a conflict of requirements occurs, the more stringent shall be deemed acceptable:

1. NEC Article 725
2. NEC Article 800
3. TIA 568A/B
4. UL 294 Access Control Systems

B. Contractor organization shall have a minimum of 5 years' experience installing, configuring and servicing the IESS software applications.
1. Contractor must be a factory authorized reseller of all major IESS head end components and software.

C. Contractor personnel for the project shall include, the following qualified resources at a minimum for the duration of the project:
1. A dedicated project manager, with a minimum of 3 years' experience managing IESS installation of similar scope and design.
2. A dedicated IESS designer, factory trained proficient in, and with no less than 3 years' experience in the design, installation, configuration, and maintenance of the major IESS components and software.
3. Installation and Service Technicians, with a minimum of 2 years' experience, factory trained and proficient in: the installation and maintenance of the major IESS components and software; wire selection, sizing, and installation; wire termination methods; power supply installation; camera housing and lens selection and installation; camera image adjustments and optimization.

D. Notify Owner in writing where Contractor does not have the requisite installation and design experience for any equipment or materials identified in the specifications.

E. Substitutions: All proposed substitutions shall be submitted and approved prior to procurement.

F. Verify compatibility of all equipment that is to be furnished and integrated under this scope of work.

G. Notify Owner in writing where the actual dimensions or appearance of installed materials or equipment will vary from the submitted and approved materials and equipment.

H. Insurance: Provide evidence of insurance for the full value of equipment and material located on-site. Insurance shall cover losses due to fire, theft and vandalism, until the final acceptance of the system, by the Owner. Maintain additional liability insurance to protect the supplier and/or Owner, Architect, Design Consultant against damage claims for personal injury, including death, which may arise during the performance of this work.

1.05 DEFINITIONS AND ABBREVIATIONS

A. Brunswick County Schools and their designated appointees and representatives shall be referred to in this document as Owner. The respondent to this scope of work shall be referred to as Contractor.

B. Definitions:
1. Final acceptance:
a. Owner’s written acknowledgement of the successful completion of the scope or a portion of the scope of work.
2. Fully functional and operational:
a. Ready for Owner use and providing all functionality and performance characteristics as defined in the specifications and drawings.
3. Notify in writing:
a. Use of either paper or electronic documentation for project communication

1.06 SUBMITTALS

A. Contractor shall comply with the General Requirements and General Conditions of this Specification.

B. Bid Submittals: Contractor shall submit the following qualification documents with the bid proposal:
1. Firm description of the Contractor, and a copy of the Contractor’s license, as well as a statement regarding the relationship of the License Holder to the Contractor.
2. Provide a minimum of ten related projects, four of which must have been completed within the last 12 months.
3. Résumé of Project Manager and onsite Foreman/Project Supervisor documenting related experience. Foreman/Project Supervisor must have completed at least two similar installations in the past 12 months. Indicate any certifications held by the Project Manger and onsite Foreman/Project Supervisor such as PMP or other.
4. Project Manager and Foreman/Project Supervisor cannot be changed without approval of Owner.
5. Submit a list of major equipment components, along with any deviations, to the system design and Specification. Indicate which products will not be purchased directly from the manufacturer.
6. Submit a list including names, firm description, job foreman, copy of license and scope of work, for any subcontractors whose work would be part of this Contract.
7. Submit a list of names for the lead installers who will be working on this project and indicate for each, any certifications held.

C. Construction Submittals
1. Before ordering equipment, submit an electronic equipment cut sheet book:
a. Organize book by specification section, first by applicable specification section, then by manufacturer name and part name or number. For devices required by drawing references, add these devices to the end of the specification submittal data sheets.
b. Include an alphabetized index at the front of each binder. Use consistent text font, alignment and justification.
c. Include a manufacturer’s cut sheet for each unique type of material or equipment to be supplied. Annotate cut sheets to indicate the specific equipment models proposed, and all proposed options and accessories.
d. Submit manufacturer's product literature showing cable specifications including NEC Type and UL listing information to verify compliance with this specification. Clearly identify all proposed substitutions, variances and exceptions.

e. Submit proposed changes to camera mounting methods and heights, camera angle/orientation, if required, for compatibility with coverage requirements.

2. A list of proposed substitutions, if any.
   a. Identify all proposed equipment substitutions. Identify all instances where a part other than that specified is proposed for use. All proposed substitutions shall be submitted and approved by the Owner or architect prior to procurement.
3. Proposed system riser and communications diagrams.
   a. Show all equipment head end locations.
   b. Show all data communications methods between security head end equipment and client provided equipment.
   c. Indicate any transition between data communications methods or communications cable types. Show each typical major head end equipment component and the quantity contained in each location.
   d. Show each typical field equipment component and cable, with aggregated quantities, for each destination equipment location.
      i. Use device symbols and abbreviations consistent with those used on the drawings.
      ii. Key cable types to the submitted and approved cable legend.
4. Proposed point to point wiring diagrams for all equipment and components.
   a. Provide a typical wiring diagram for each instance of field device wiring
      i. Standard wiring diagrams from manufacturer's installation manuals are acceptable *where standard wiring is proposed*.
      ii. For each wiring diagram identify applicable details or equipment locations by the reference or device number(s) shown on the drawings.
   b. Provide specific point to point wiring diagrams for interfaces to third party control equipment and specialty portals, listed below.
   c. Provide a point to point diagram for each access control panel.
      i. Create panel point to point diagrams in Microsoft Visio or equivalent.
      ii. Show each board and its terminals in spatially accurate location and orientation.
      iii. Show each terminal and punch block.
      iv. Show data communication connections.
      v. Show power distribution and connections.
      vi. Show each specific security device symbol and component with connections to the boards in the panel: indicate the device type, device number, and description. Identify all terminals by function with text labels.
      vii. Identify all cables and conductor by type with text tag.
5. Proposed cable legend with proposed manufacturers and model numbers.
6. Proposed loading schedule and addressing for all system device points.
   a. Include the following information:
      i. Device number as shown on plan drawings
      ii. Proposed system device name
      iii. Room name and number, or other device location
      iv. Device type description or abbreviations as shown on plan drawings
      v. Destination equipment room (IDF, SER, etc.)
      vi. Specific port and address of device.
   b. Review existing Owner naming standards prior to submitting loading schedules. Conform to existing standards.
   c. Use consistent abbreviations in all system device names.

7. Proposed testing reports:
    a. Create and submit for Owner approval a testing report for each detail or equipment type.
        i. Include a line item for each instance of each numbered functional or technical requirement identified in the security drawings and in the appropriate specification section.
        ii. Test reports should include: The device number and room number, as indicated in the drawings, of each device tested, an indication of the result of each test, the signature of the project manager and installation technician, with the date of the test.
    b. Include a test report for any additional tests recommended or required by the manufacturer of each piece of equipment.
8. Submit for Owner approval, not less than 10 business days prior to Owner's final acceptance test.
    a. Composite Equipment Manuals. Submit copies of all installation, operation and maintenance manuals for all equipment.
    b. Include all manuals, installation guides, instruction sheets, data sheets and any related literature from the original shipping containers for the equipment.
        i. Include all warranty cards in a separate container.
    c. Organize the Composite Equipment Manuals alphabetically, first by manufacturer name, and then by product part number or name.
9. Final project record documents (copies of current "red-lines"). See 1.6, A, 3 below.
10. Completed testing forms.
    a. Create and submit a completed testing report for each instance of each detail or equipment type following the completion of all installation and configuration work.
        i. Include a line item for each instance of each functional and technical requirement identified in the security drawings and in this section.
    b. Test reports should include:
        i. The device number or room number, as indicated in the drawings, of each device tested.
        ii. The result of each test.
        iii. The signature of the project manager and installation technician, with the date of the test.
11. Include a test report for any additional tests recommended or required by approved equipment manufacturers.

1.07 PROJECT CLOSE OUT

A. General
    1. Submit for Owner approval, no more than 10 business days after Owner's final acceptance test.
        a. Use the design drawings as the basis for the as-built drawings. Obtain electronic copies from the system designer, architect or general contractor.
        b. Include the following information
            i. Accurate locations of all pull boxes, security junction boxes and access locations for raceways.
            ii. Accurate location of all equipment installed under this SOW.
            iii. A complete equipment list for each head-end location, including manufacturer name, model number, firmware version and quantities for each major component.

iv. Electrical breaker panel and circuit identifiers for input AC power for all IESS equipment and power supplies.

2. Final riser and communications diagrams.
3. Final loading and addressing schedules.
4. Final Point-to-point wiring diagrams.
5. Final testing reports (as required following Owner's final acceptance test).
6. Warranty Letter ready for Owner signature.

1.08 GUARANTEES AND WARRANTIES

A. Provide a warranty to cover all parts and labor to remain in effect for one year from the date that the warranty letter is signed by Owner, unless the manufacturer's equipment warranty exceeds 1 year, in which case the equipment warranty period shall be the longer of the two. The warranty expiration date shall be specified within the warranty letter and agreed to by the Owner.

B. For all new equipment installed under the contract:
1. Provide materials and labor as required for the duration of the warranty period to repair and correct any of the following conditions:
a. Defects in material.
b. Defects in workmanship.
c. Defects in design or implementation.
d. Product not new or not of the kind and quality specified.
e. Product not suitable for the use intended.
f. Product not performing in the manner specified.
2. Equipment warranty will exclude repairs to Owner provided equipment.

C. Respond to all Owner requests for warranty service according to terms and conditions defined in section 1.10, Service Levels, below.

D. Owner may place requests for service both prior to final acceptance and during the warranty period.

E. Provide normal warranty service at no additional cost to Owner during normal business hours, which are between 7:00 AM and 5:00 PM, Monday through Friday.

F. Provide emergency service at an additional cost to Owner, upon Owner request.
1. All Emergency Service within the first year warranty period will be performed and billed using the labor rates submitted at the time of bid.

G. Response time is the elapsed time measured from when a problem is first reported by an Owner representative to Contractor's designated help line, to when a qualified Contractor technician arrives on site and begins working on the problem (or via phone if approved by Owner).
1. Required response times:
a. Normal Service:
i. Within 4 hours for all calls placed before 1:00pm.
ii. By 7:00 am the following business day for all calls placed after 1:00pm.
b. Emergency Service: within 2 hours.

H. Resolution time is the elapsed time measured from when an Owner representative first reports a problem, to when the system has been restored or an acceptable work-around has been implemented
1. Required resolution times:

a. Normal Service: 1 business day.
b. Emergency Service: 4 hours.

2. If the resolution time expires without problem resolution, Contractor will provide:
a. A written explanation for the delay along with an estimate of the time required for fully restoring the system to complete functionality. (Due within 1 business day).

I. Owner will classify all service calls as “Normal” or “Emergency” at the time the call is placed.

J. Contractor’s service dispatch and response personnel will possess a written definition of and be trained in:
1. Required Response times.
2. Required Resolutions times.

K. The conditions of the service levels will apply through the conclusion of the warranty period.

PART 2 - PRODUCTS

2.01 GENERAL

A. Contractor is responsible for identifying all equipment necessary for a fully functional and operational IESS. Review the specifications and drawings to identify all products, materials and components required to provide the functionality indicated at the locations shown. Verify all required quantities.

B. Coordinate with Owner on integrating proposed new system device(s) as indicated on the plan drawings connecting with existing ACS systems/components.

C. Provide all functionality as defined in the drawings and details.

D. This specification may contain parts and/or equipment that are not specifically included in this project. Refer to drawings to confirm all required device types and quantities.

2.02 CONDUCTORS, CABLES AND CONNECTORS

A. GENERAL
1. All cables shall be UL listed for the intended use
2. When cable is to be installed in wet locations as defined by NEC, provide "Water Blocked" cable listed for use in such locations.
3. Cables shall meet or exceed NEC classifications as follows:
a. Article 725 Class 1, Class 2, and Class 3 Remote-Control, Signaling, and Power-Limited Circuits
1) Commercial Cable Types: Type CM, CMG or CL2
2) Riser Cable Types: Type CMR or CL2R
3) Plenum Cable Types: Type CL2P
b. Article 800 Communications Circuits
1) Commercial Cable Types: Type CM or CMG
2) Riser Cable Types: Type CMR
3) Plenum Cable Types: Type CMP

4. Cable Marking
   a. Provide manufacturers name, manufacturers part number, manufacturers UL file number and sequential foot markers not more than every 2 feet along the entire cable length.

5. Shield/drain wiring requirements
   a. All shield/drain wires shall have clear vinyl insulating tubing installed over bare conductor from 1/8” below (inside) the cable jacket to within 1/8” of the wire attachment point, screw terminal and the like.
   b. Multiple shield/drain wires may not share a single insulated tubing.
   c. ID of insulated tubing shall not be more than 50% larger than the shield/drain wire diameter.

B. CABLES AND CONDUCTORS
1. Belden 2413 Enhanced CAT 6 Non-Bonded cable, no substitutions
   a. Plenum rated Cable
   b. Exterior color - Violet

2. Wiring, Multiconductor with Flamearrest Jacket
1. Belden 6302FE 4 Conductor bare copper cable, no substitutions
   a. 18AWG
   b. Beldfoil outer shield

C. INSULATION DISPLACEMENT CONNECTORS
1. 3M Scotchlok™ Insulation Displacement Connectors (Solid wires only).
   a. Dry type
      1) UAL, UP2, UP3, UR2-D, UY2-D etc. or approved equal.
   b. Gel Filled
      1) UG, UR, UY2, etc. or approved equal.
2. Utilize only single stroke, parallel jaw, and ratchet-release connector tool with minimum 10:1 mechanical advantage or approved equal. Use of non-ratchet style connector tools is not acceptable.

D. INSULATED ELECTRICAL CRIMP SLEEVE CONNECTORS
1. 3M Scotchlok S-11.
   a. 22 AWG to 14 AWG.
   b. UL Listed.
   c. CSA Certified.
   d. 091” ID copper insert.
2. 3M Scotchlok S-31.
   a. 18 AWG to 10 AWG.
   b. UL Listed.
   c. CSA Certified.
   d. 152” ID copper insert.

3. Tyco Electronics D-200-0228, In-line solder/crimp with heat shrink sleeve, Red
   a. 20 AWG to 26 AWG
      1) Use at all wired hinge connection locations
4. Tyco Electronics D-200-0229, In-line solder/crimp with heat shrink sleeve, Blue
   a. 16 AWG to 20 AWG

E. WIRE & CABLE LABELS
1. Labels shall be sleeved heat shrink type, machine-printed, polyolefin wire markers for all cables, or approved equal.

2. Provide Brady IDXpert labeler or approved equal.
   a. Model XPERT-ABC
   b. Wire label for control cables, wire wrap style
      1) Brady X-19-498 label cartridge, 1” H x 1” W
   c. Wire label for large wires or cords (wire wrap style) or flat label
      1) Brady X-21-498 label cartridge, 1” H x 2 1/2” W
   d. Wire label for outlets or boxes
      1) Brady X-61-483 label cartridge, 1/2” H x 2” W
   e. Wire label for small outlet boxes
      1) Brady X-17-422 label cartridge, 1/2” H x 1” W
   f. Large label for general use
      1) Brady XC-1000-595-WT-BK, 1” W x continuous

2.03 TERMINAL BLOCKS

A. TERMINAL BLOCKS
   1. Phoenix Contact MBK 2,5/E or approved equal
      a. Feed through style, 24 – 14 AWG wire, DIN rail mount
      b. Phoenix Contact E/MBK End bracket or approved equal
      c. Phoenix Contact NS 15 PERF 2000MM DIN rail or approved equal
      d. Phoenix Contact terminal labels or approved equal

   2. TAMPER SWITCHES
      a. Provide tamper switch for interior enclosures per section 2.8, B, 1

2.04 POWER SUPPLIES

A. GENERAL
   1. Furnish each power supply assembly manufactured as an integral unit, complete with all parts and ready for field installation.
   2. Power Supplies shall have UL listing marks for the intended categories:
      a. UL294 Access Control Systems.
   3. Power Supplies shall be Class 2 power limited.
   4. Power Supplies shall have lifetime warranty.

B. Ethernet Switch Power Supply
   1. TrendNet 120 W Single Output Industrial (TI-S12048), no substitutions
      a. DIN-Rail Power Supply
      b. Provides up to 120 Watts of power (48 V, 2.5 A)
      c. Built-in active PFC (PF > 0.93)

C. Fiber Converter Power Supply
   1. TrendNet 60 W Single Output Industrial (TI-M6024), no substitutions
      a. DIN-Rail Power Supply
      b. Provides up to 60 Watts of power (48 V, 2.5 A)
      c. Rated to -20 Celsius operating temperature

D. BACK UP BATTERIES
   1. Powersonic PS1270, 12 VDC, 7 Amp Hour or approved equal, UL Listed
      a. Provide 1 battery for every 12 VDC power supply
      b. Provide 2 batteries (series connected) for every 24 VDC power supply

2.05 ACCESS CONTROL SYSTEM

A. GENERAL
1. Contractor is responsible for identifying all equipment necessary for a fully functional and operational ACS addition to the Owner's currently functioning Lenel ACS.
2. Review the specifications and drawings to identify all products and components required to provide a complete and fully functional system.
3. Verify all required quantities.

B. EQUIPMENT AND MATERIALS

A. Access Control System Equipment
1. Card Reader, Wall mounted
    1. To match Owners existing hardware
2. Electric Lockset with internal REX switch
    1. To match Owners existing hardware
3. Electric Lockset with internal Power Transfer Hinge / Pivot
    1. To match Owners existing hardware

B. SYSTEM INTERFACES AND INTEGRATION
1. None required

2.06 VIDEO CAMERA SYSTEMS

A. GENERAL
1. Contractor is responsible for identifying all equipment necessary for a fully functional and operational Camera System .
2. Review the specifications and drawings to identify all products and components required to provide a complete and fully functional system.
3. Verify all required quantities.

B. EQUIPMENT AND MATERIALS

A. Parapet, Dome and Building Mounted Cameras
1. 1080P PTZ Camera
2. Indoor/Outdoor rated
3. Dimensions 232mm X 280mm X 280mm
4. Accessories / mounting hardware as required.
5. Axis P5635-E MkII PTZ Dome Network Camera, w/ 30X Zoom lens

B. Dome Ceiling Mounted Cameras
1. 1080P Camera
2. Indoor rated
3. Dimensions 91mm X 36mm
4. Accessories / mounting hardware as required.
5. Axis M3015 Network Camera

C. Bullet Ceiling and Wall Mounted Cameras
1. 1080P Camera
2. Indoor rated
3. Dimensions 91mm X 36mm
4. Accessories / mounting hardware as required.
5. Axis P1435-LE Network Camera

D. 360-degree Ceiling Mounted Camera
   1. 12MP Camera
   2. Indoor/Outdoor rated
   3. Dimensions 66mm X 149mm
   4. Accessories / mounting hardware as required.
   5. Axis M3058-PLVE 360 degree Network Camera

2.07 SECURITY EQUIPMENT WIRE HANDLING DEVICES AND CAT 6 PATCH CABLES

A. Furnished, installed and provisioned by owner.

PART 3 - EXECUTION

3.01 EXAMINATION

A Verify site conditions are appropriate and satisfactory to accept the equipment and work identified in this section and in the project drawings. Do not begin installation until all unsatisfactory conditions have been corrected.

B. Verify all rough-in is completed as show on Architectural, Civil and/or Electrical drawings prior to installation of IESS equipment.

C. All IESS equipment and components shall be inspected and tested in the Contractor's facility for workmanship dimensions and finishes per the manufacturer's specification and the procurement order. Verify that equipment is free from physical defects prior to installation.

D. Observe cable manufacturer's color coding for individual conductors or pairs and apply consistent color coding for similar devices across all installed locations.

E. Verify all cable distances for compatibility with IESS devices, including but not limited to:
   1. Cameras, illuminators and media converter power and data communication requirements.
   2. Notify Owner in writing where measured cable run distances shall exceed manufacturer's specifications or common standards for power and data.

3.02 SHIPPING

A. Equipment and components shall be packaged as necessary to prevent damage from handling. The shipping container(s) shall maintain their structural integrity when transported by common carrier or installer's vehicle.

3.03 COORDINATION AND PREPARATION

A. Coordinate all security tasks and milestones with the general contractor for inclusion in the project schedule.
   1. Identify all tasks on the project critical path.
   2. Identify all system testing and close-out tasks.
   3. Include all equipment burn in, orientation and training activities required by Owner.

B. Provide documentation to and coordinate with the Electrical Contractor for the timely installation of all required conduit, junction boxes, metal wire gutters and 120VAC power.

C. Provide documentation to and coordinate with the Low Voltage Systems Contractor for the timely installation of all vertical and horizontal data network infrastructure.

D. Provide documentation to and coordinate with the appropriate suppliers for the timely installation of all doors and door hardware.

3.04 INSTALLATION – CABLE

A. By owner by others.

B. Obtain specific approval from Owner for the location and appearance of any cable or raceway that is not hidden.

C. Coordinate with the Electrical Contractor for the timely installation of all required conduit, junction boxes and pull strings.

D. Coordinate with the Electrical Contractor to obtain information on conduit and junction box locations as required for the accurate completion of all project record and as-built documentation.

E. Comb wire groups. Route and support all wiring and cable to achieve the highest quality appearance in all areas, including the interior of all panels and racks.

F. Install a maximum of two wires to any single screw terminal.

G. Wiring Inspection
   1. Visually inspect wire and cable for faulty insulation prior to and during installation.
   2. After installation, visually inspect all wiring for flaws such as cuts, punctures and abrasions. If any flaws are found, replace the wire at no additional cost to Owner.

3.05 INSTALLATION – GENERAL

A. This contract involves integration to currently functioning systems. Coordination with Owner is critical. Do not interrupt any functioning system without prior coordination with Owner.
   1. Schedule all work required at current project site with Owner a minimum of 48 hours in advance. Submit work requests in writing to Owner's representative, and include:
      a. Description of work to be performed.
      b. Name of resource(s) to perform the work.
      c. Expected duration.
      d. Projected system down time and risks to operations.
   2. Following configuration of the first equipment in the IESS software, submit to Owner and maintain the Installation Status Report summary as defined above. Update as often as necessary to communicate any changes in device installation status.

B. Comply with all manufacturers' written installation instructions, unless more stringent requirements are indicated. Notify Owner of all conflicts between construction documents and written manufacturer's requirements. Resolve all conflicts prior to installation.

C. If any technical problem or malfunction occurs, and if in Owner's judgment adequate progress is not being demonstrated in resolving the problems, provide manufacturers' factory technical representatives and diagnostic equipment at no additional cost to Owner until the problems are resolved to Owner's satisfaction.

D. Aesthetics are an important consideration in this installation. Install all components to provide aesthetically pleasing results. Coordinate the actual locations of all visible components in advance with Architect and Owner.

E. Perform all installation in a professional and workmanlike manner.

F. Consistency of installation:
   1. Install all equipment and parts of the same type in a consistent manner throughout the entire project. Include in the consistency of installation, at a minimum, the following:
      a. Wire type and brand
      b. Wire color coding
      c. Wire tagging
      d. Terminal board connection order
      e. Physical layout in security junction boxes and equipment enclosures

G. Provide Velcro wire dressing materials for wiring inside all panels, enclosures and racks.

H. Install all equipment and parts plumb and true at locations shown on the drawings.

I. Connections to door hardware (door hardware provided by others) are to be installed to best industry standards. Electrified door hardware is to be configured as fail-secure, with the unlock function initialized from the ACS.

J. Install all equipment so that outlet boxes and back boxes are fully concealed.

K. Install all accessible components with tamper resistant security fasteners.
   1. Provide and install tamper resistant security fasteners on all exposed and accessible pull boxes and junction boxes.
   2. Provide a minimum of 2 compatible tools to Owner prior to final acceptance for use with tamper resistant fasteners.

L. Before commencing installation of any powered component, confirm that the necessary electrical power and grounding provisions are available to meet the manufacturer's stated requirements.

M. Cutting, Sealing, Patching, and Painting
   1. Do not drill, bore or notch any structural member in any manner that impairs its structural value.
      a. If cutting holes in structural members is required, only use core drills and only with the specific approval of Owner for each instance.
      b. Any required core drilling shall include Link-Seal protection.
   2. Patching, painting, and repairs the buildings to facilitate conduit and mount installations will be by Owner.
   3. Coordinate all repair needs with Owner prior to final install.
   4. Contractor is responsible for all outdoor device painting as required.

N. Installation Status Reporting.
   1. Create and maintain an up-to-date list of all equipment locations by device or room number, indicating the installation status of the field devices and the equipment at the IESS head-end locations.
   2. Provide a summary report of all equipment and devices that are or will be configured in the IESS software, sorted by device number and device description. Indicate when each device is:
      a. Rough-in
      b. Configured in the software but not fully installed and/or tested.
      c. Installed
      d. Installed, fully tested and available for Owner's use and monitoring.
   3. Installation status reports will be updated on a daily basis at a minimum.

O. System programming and device naming
   1. Owner to provide programming sheets to be completed by the VAR per the Owner's specified format. Once the Owner has reviewed and approved the programming sheets, the program IESS.

3.06 ADJUSTING

A. Adjust all equipment and components after installation for proper and smooth operation.

B. Complete all required adjustments prior to commencing cleaning, training or testing.

3.07 CLEANING

A. On a daily basis, clean up all debris from work performed and deposit in the appropriate containers.
   1. Stack and organize all parts, tools and equipment when not being used.

B. Protect, and where necessary, cover all installed devices to protect from dust and debris during construction/installation.

C. At the conclusion of the installation work in all areas (including all enclosures), vacuum and clean to remove all debris, grease and smudges.

D. Repair damaged

3.08 TRAINING

A. Training requirements: refer to specific system sections.

B. Where specific system sections do not mention training session numbers and length, provide a minimum of 8 hours of total user training combined for all major systems, including Access Control, Video Management and Video Cameras.

3.09 TESTING

A. Test and verify the fully functional and operational status of each field device prior to Owner's final acceptance testing.

B. Verify compliance with each functional and technical requirement at each location as defined in the drawings and the specifications.

C. Document test results using approved testing reports.

D. All completed testing reports will be signed and dated by Contractor's installation technician and project manager prior to delivery to Owner for use in performing the final acceptance test.

E. Successful testing of all devices and equipment is required. Failure to complete and document the tests will delay Owner's final testing and acceptance.

F. Attend and assist with Owner verification testing.

G. All test failures or instances of non-compliance with the drawings, approved submittals, this section, and referenced related sections will be added to an Owner-generated punch list as items to be repaired or remedied. Excessive punch list items will result in the rescheduling of Owner's final acceptance test.

1. Contractor shall remedy or repair all punch list items within 10 business days of punch list generation.
2. Exception: punch list items that cannot be remedied due to Owner caused delays will be remedied 5 business days following Owner notification

3.10 CLOSE OUT

A. Owner will provide final acceptance of the work contingent on the successful completion of all punch list items.

B. The following conditions must be met in order for any portion of the work to be considered by Owner for final acceptance:
1. Each piece of electronic equipment must be properly grounded prior to applying power.
2. All wire shields must be insulated with clear vinyl tubing and grounded to the appropriate earth ground at the head or controller end only, not at the remote or device end.
3. Disconnect, remove and dispose off-site of all temporary equipment and utilities.
4. Label and identify all systems, equipment and devices.
5. Labeling for all wiring must match as-built documentation.
6. Have all systems, equipment and devices in full and proper adjustment and operation.
7. Have all equipment and materials in neat, clean and unmarred condition with parts securely attached.
8. Replace or properly repair all broken work, including glass, raised flooring and supports, ceiling tiles and supports, walls, doors, etc. Clean up and appropriately discard all debris.
9. Deliver and store all extra materials at the premises as directed.

C. Once all conditions for final acceptance defined above have been satisfied, perform the following in preparation for Owner's final acceptance test:
1. Complete and submit all required testing reports.
2. Submit final redlined project record documentation to Owner for comment and approval.
3. Notify Owner in writing of any work in the building that will not be completed at the time of Owner's final acceptance test.
    a. Deliver this notification no less than one business day prior to the scheduled test time and date.

D. After Owner approves test reports and project record drawings, test the completed security systems in the presence of Owner. Demonstrate performance and compliance with specifications, drawings and details. This demonstration will serve as Owner's final acceptance test.
1. Assume Owner will test and verify proper operation of all devices, Lenel controllers and boards, power supplies, and batteries.
2. Owner will use the testing reports to assist in final acceptance testing. Owner will initial or mark individual test report records at Owner's convenience only.

E. After completion of Owner's final acceptance test, incorporate all Owner requested changes and corrections to the project record drawings, and transfer all data information to a final set of as-built documents.

F. Complete the Owner generated punch list following the final acceptance test. Notify Owner when all punch list items have been completed. Demonstrate completion of all punch list items in the presence of Owner.
1. Owner will sign and date each testing report to acknowledge proper operation of each device listed.

G. Deliver all spare parts to Owner with an itemized list.

H. Letter of Completion.
   1. After the system acceptance requirements described above for each portion of the work have been satisfactorily completed, Owner will, within 3 business days, issue a letter of completion to Contractor, acknowledging punch list completion and receipt of as-built documents.
   2. The invoice for final payment may be submitted following Owner's acknowledgement of punch list completion and receipt of final as-built documents.

I. Warranty Letter.

   Issue a warranty letter to Owner within 3 business days of receipt of the letter of completion. The date of the warranty letter shall be the start of the warranty period.

END OF SECTION 28 05 00

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SECTION 28 31 00 – FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section of the specifications includes the furnishing, installation, and connection of a new addressable fire alarm equipment to form a complete coordinated system ready for operation. It shall include, but not be limited to, alarm initiating devices, chime/strobe alarm notification appliances, control units, fire safety control devices, annunciators, power supplies, and wiring as shown on the drawings and specified. The fire alarm system shall not be combined with other systems such as building automation, energy management, security, etc.

B. Fire alarm systems shall comply with requirements of the most recent NC FIRE CODE and NFPA 72 unless variations to NFPA 72 are specifically identified within these contract documents by the following notation: "variation". The design, system layout, document submittal preparation, and supervision of installation and testing shall be provided by a technician that is certified NICET level III or a registered fire protection engineer. The NICET certified technician shall be on site for the supervision and testing of the system. Factory engineers from the equipment manufacturer, thoroughly familiar and knowledgeable with all equipment utilized, shall provide additional technical support at the site as required by the Architect or his authorized representative. Installers shall have a minimum of 2 years' experience installing fire alarm systems.

C. Fire alarm signals:
   1. Building shall have an automatic digitized voice fire alarm signal with emergency manual voice override to notify occupants to evacuate. The digitized voice message shall identify the area of the building (smoke zone) from which the alarm was initiated.
   2. Building shall have a general evacuation fire alarm signal in accordance with ASA S3.41 to notify all occupants in the respective building to evacuate.

D. Alarm signals (by device), supervisory signals (by device) and system trouble signals (by device not reporting) shall be distinctly transmitted to the main fire alarm system control unit located in the electrical room.

E. The main fire alarm control unit shall automatically transmit alarm signals to the listed central station using a digital alarm communicator transmitter in accordance with NFPA 72.

1.2 SCOPE

A. A fully addressable fire alarm system as an extension of a new addressable fire alarm system shall be designed and installed in accordance with the specifications and drawings. Device location and wiring runs shown on the drawings are for reference only unless specifically dimensioned. Actual locations shall be in accordance with NFPA 72 and this specification.
B. Basic Performance:
   1. Alarm and trouble signals from each building fire alarm control panel shall be digitally encoded by UL listed electronic devices onto a multiplexed communication system.
   2. Response time between alarm initiation (contact closure) and recording at the main fire alarm control unit (appearance on alphanumeric read out) shall not exceed 5 seconds.
   3. The signaling line circuits (SLC) between building fire alarm control units shall be wired Style 7 in accordance with NFPA 72. Isolation shall be provided so that no more than one building can be lost due to a short circuit fault.
   4. Initiating device circuits (IDC) shall be wired Style C in accordance with NFPA 72.
   5. Signaling line circuits (SLC) within buildings shall be wired Style 4 in accordance with NFPA 72. Individual signaling line circuits shall be limited to covering 22,500 square feet (2,090 square meters) of floor space or 3 floors whichever is less.
   6. Notification appliance circuits (NAC) shall be wired Style Y in accordance with NFPA 72.

1.3 RELATED WORK

A. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Requirements for procedures for submittals.
B. Section 07 84 00 - FIRESTOPPING. Requirements for fire proofing wall penetrations.
C. Section 08 71 00 - DOOR HARDWARE. For combination Closer-Holders.

D. Section 21 13 13 - WET-PIPE SPRINKLER SYSTEMS. Requirements for sprinkler systems.
E. Section 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Requirements for conductors and cables.

1.4 SUBMITTALS

A. General: Submit 5 copies in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, and Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
B. Drawings:
   1. Prepare drawings using AutoCAD Release 2014 or later software and include all contractors' information. Layering shall be per the National CADD Standards. The contractor shall be responsible for verifying all critical dimensions shown on the drawings.
   2. Floor plans: Provide locations of all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, equipment, junction/terminal cabinets/boxes, risers, electrical power connections, individual circuits and raceway routing, system zoning; number, size, and type of raceways and conductors in each raceway; conduit fill calculations with cross section area percent fill for each type and size of conductor and raceway. Only those devices connected and incorporated into the final system shall be on these floor plans. Do not show any removed devices on the floor plans. Show all interfaces for all fire safety functions.
   3. Riser diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wiring Styles on the riser diagram for all circuits. Provide diagrams both on a per building and campus wide basis.
   4. Detailed wiring diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators,

adjustable controls, switches, ribbon connectors, wiring harnesses, terminal strips and connectors, spare zones/circuits. Diagrams shall be drawn to a scale sufficient to show spatial relationships between components, enclosures and equipment configuration.

5. Two weeks prior to final inspection, the Contractor shall deliver to the OWNER 3 sets of as-built drawings and one set of the as-built drawing computer files (using AutoCAD 2014 or later). As-built drawings (floor plans) shall show all new and/or existing conduit used for the fire alarm system.

C. Manuals:

1. Submit simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets for all items used in the system, power requirements, device wiring diagrams, dimensions, and information for ordering replacement parts.
   a. Wiring diagrams shall have their terminals identified to facilitate installation, operation, expansion and maintenance.
   b. Wiring diagrams shall indicate internal wiring for each item of equipment and the interconnections between the items of equipment.
   c. Include complete listing of all software used and installation and operation instructions including the input/output matrix chart.
   d. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate, inspect, test and maintain the equipment and system. Provide all manufacturer's installation limitations including but not limited to circuit length limitations.
   e. Complete listing of all digitized voice messages.
   f. Provide standby battery calculations under normal operating and alarm modes. Battery calculations shall include the magnets for holding the doors open for one minute.
   g. Include information indicating who will provide emergency service and perform post contract maintenance.
   h. Provide a replacement parts list with current prices. Include a list of recommended spare parts, tools, and instruments for testing and maintenance purposes.

i. A computerized preventive maintenance schedule for all equipment. The schedule shall be provided on disk in a computer format acceptable to the VAMC and shall describe the protocol for preventive maintenance of all equipment. The schedule shall include the required times for systematic examination, adjustment and cleaning of all equipment. A print out of the schedule shall also be provided in the manual. Provide the disk in a pocket within the manual.

j. Furnish manuals in 3 ring loose-leaf binder or manufacturer's standard binder.

k. A print out for all devices proposed on each signaling line circuit with spare capacity indicated.

2. Two weeks prior to final inspection, deliver 4 copies of the final updated maintenance and operating manual to the OWNER.

a. The manual shall be updated to include any information necessitated by the maintenance and operating manual approval.

b. Complete "As installed" wiring and schematic diagrams shall be included that shows all items of equipment and their interconnecting wiring. Show all final terminal identifications.

c. Complete listing of all programming information, including all control events per device including an updated input/output matrix.

d. Certificate of Installation as required by NFPA 72 for each building. The certificate shall identify any variations from the National Fire Alarm Code.

e. Certificate from equipment manufacturer assuring compliance with all manufacturers installation requirements and satisfactory system operation.

D. Certifications:

1. Together with the shop drawing submittal, submit the technician's NICET level III fire alarm certification as well as certification from the control unit manufacturer that the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include in the certification the names and addresses of the proposed supervisor of installation and the proposed performer of contract maintenance. Also include the name and title of the manufacturer’s representative who makes the certification.

2. Together with the shop drawing submittal, submit a certification from either the control unit manufacturer or the manufacturer of each component (e.g., smoke detector) that the components being furnished are compatible with the control unit.

3. Together with the shop drawing submittal, submit a certification from the major equipment manufacturer that the wiring and connection diagrams meet this specification, UL and NFPA 72 requirements.

1.5 WARRANTY

A. All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Architect.

1.6 GUARANTEE PERIOD SERVICES

A. Complete inspection, testing, maintenance and repair service for the fire alarm system shall be provided by a factory trained authorized representative of the manufacturer of the major equipment for a period of 5 years from the date of acceptance of the entire installation by the Architect.
B. Contractor shall provide all necessary test equipment, parts and labor to perform required inspection, testing, maintenance and repair.
C. All inspection, testing, maintenance and permanent records required by NFPA 72, and recommended by the equipment manufacturer shall be provided by the contractor. Work shall include operation of sprinkler system alarm and supervisory devices as well as all reused existing equipment connected to the fire alarm system. It shall include all interfaced equipment including but not limited to elevators, HVAC shutdown, and extinguishing systems.
D. Maintenance and testing shall be performed in accordance with NFPA 72. A computerized preventive maintenance schedule shall be provided and shall describe the protocol for preventive maintenance of equipment. The schedule shall include a systematic examination, adjustment and cleaning of all equipment.
E. Non-included Work: Repair service shall not include the performance of any work due to improper use, accidents, or negligence for which the contractor is not responsible.
F. Service and emergency personnel shall report to the Engineering Office or their authorized representative upon arrival at the hospital and again upon the completion of the required work. A copy of the work ticket containing a complete description of the

work performed and parts replaced shall be provided to the Architect or his authorized representative.

G. Emergency Service:
   1. Warranty Period Service: Service other than the preventative maintenance, inspection, and testing required by NFPA 72 shall be considered emergency call-back service and covered under the warranty of the installation during the first year of the warranty period, unless the required service is a result of abuse or misuse by the Government. Written notification shall not be required for emergency warranty period service and the contractor shall respond as outlined in the following sections on Normal and Overtime Emergency Call-Back Service. Warranty period service can be required during normal or overtime emergency call-back service time periods at the discretion of the Architect or his authorized representative.
   2. Normal and overtime emergency call-back service shall consist of an on-site response within 2 hours of notification of a system trouble.
   3. Normal emergency call-back service times are between the hours of 7:30 a.m. and 4:00 p.m., Monday through Friday, exclusive of federal holidays. Service performed during all other times shall be considered to be overtime emergency call-back service. The cost of all normal emergency call-back service for years 2 through 5 shall be included in the cost of this contract.
   4. Overtime emergency call-back service shall be provided for the system when requested by the Government. The cost of the first 40 man-hours per year of overtime call-back service during years 2 through 5 of this contract shall be provided under this contract. Payment for overtime emergency call-back service in excess of the 40 man hours per year requirement will be handled through separate purchase orders. The method of calculating overtime emergency call-back hours is based on actual time spent on site and does not include travel time.

H. The contractor shall maintain a log at each fire alarm control unit. The log shall list the date and time of all examinations and trouble calls, condition of the system, and name of the technician. Each trouble call shall be fully described, including the nature of the trouble, necessary correction performed, and parts replaced.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. The publications are referenced in text by the basic designation only and the latest editions of these publications shall be applicable.

B. National Fire Protection Association (NFPA):
NFPA 13 .....Standard for the Installation of Sprinkler Systems, 2010 edition
NFPA 14 ..... Standard for the Installation of Standpipes and Hose Systems, 2010 edition
NFPA 20 ..... Standard for the Installation of Stationary Pumps for Fire Protection, 2010 edition
NFPA 70.....National Electrical Code (NEC), 2010 edition
NFPA 72.....National Fire Alarm Code, 2010 edition
NFPA 90A .....Standard for the Installation of Air Conditioning and Ventilating Systems, 2009 edition
NFPA 101.....Life Safety Code, 2009 edition

C. Underwriters Laboratories, Inc. (UL): Fire Protection Equipment Directory

D. Factory Mutual Research Corp (FM): Approval Guide, 2007-2011

E. American National Standards Institute (ANSI):
S3.41.....Audible Emergency Evacuation Signal, 1990 edition, reaffirmed 2008

F. International Code Council, International Building Code (IBC), 2009 edition

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS, GENERAL

A. All equipment and components shall be new and the manufacturer's current model. All equipment shall be tested and listed by Underwriters Laboratories, Inc. or Factory Mutual Research Corporation for use as part of a fire alarm system. The authorized representative of the manufacturer of the major equipment shall certify that the installation complies with all manufacturers' requirements and that satisfactory total system operation has been achieved.

2.2 CONDUIT, BOXES, AND WIRE

A. Conduit shall be in accordance with Division 26 and as follows:
   1. All new conduits shall be installed in accordance with NFPA 70.
   2. Conduit fill shall not exceed 40 percent of interior cross sectional area.
   3. All new conduits shall be 3/4 inch (19 mm) minimum.

B. Wire:
   1. Wiring shall be in accordance with NEC article 760, Section 26 05 19, and as recommended by the manufacturer of the fire alarm system. All wires shall be color coded. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG for initiating device circuits and 14 AWG for notification device circuits.
   2. Addressable circuits and wiring used for the multiplex communication loop shall be twisted and shielded unless specifically accepted by the fire alarm equipment manufacturer in writing.
   3. Any fire alarm system wiring that extends outside of a building shall have additional power surge protection to protect equipment from physical damage and false signals due to lightning, voltage and current induced transients. Protection devices shall be shown on the submittal drawings and shall be UL listed or in accordance with written manufacturer's requirements.
   4. All wire or cable used in underground conduits including those in concrete shall be listed for wet locations.

C. Terminal Boxes, Junction Boxes, and Cabinets:
   1. Shall be galvanized steel in accordance with UL requirements.
   2. All boxes shall be sized and installed in accordance with NFPA 70.
   3. covers shall be repainted red in accordance with Section 09 91 00, PAINTING and shall be identified with white markings as "FA" for junction boxes and as "FIRE ALARM SYSTEM" for cabinets and terminal boxes. Lettering shall be a minimum of 3/4 inch (19 mm) high.
   4. Terminal boxes and cabinets shall have a volume 50 percent greater than required by the NFPA 70. Minimum sized wire shall be considered as 14 AWG for calculation purposes.

5. Terminal boxes and cabinets shall have identified pressure type terminal strips and shall be located at the base of each riser. Terminal strips shall be labeled as specified or as approved by the OWNER.

2.3 FIRE ALARM CONTROL UNIT

A. General:
   1. Each building shall be provided with a fire alarm control unit and shall operate as a supervised individually addressable/zoned fire alarm system.
   2. Each power source shall be supervised from the other source for loss of power.
   3. All circuits shall be monitored for integrity.
   4. Visually and audibly annunciate any trouble condition including, but not limited to main power failure, grounds and system wiring derangement.
   5. Transmit digital alarm information to the main fire alarm control unit.

B. Enclosure:
   1. The control unit shall be housed in a cabinet suitable for both recessed and surface mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
   2. Cabinet shall contain all necessary relays, terminals, lamps, and legend plates to provide control for the system.

C. Operator terminal at main control unit:
   1. Operator terminal shall consist of the central processing unit, display screen, keyboard and printer.
   2. Display screen shall have a minimum 15-inch (380 mm) diagonal non-glare screen capable of displaying 24 lines of 80 characters each.
   3. Keyboard shall consist of 60 alpha numeric and 12 user/functional control keys.
   4. Printer shall be the automatic type, printing the date, time and location for all alarm, supervisory, and trouble conditions.

D. Power Supply:
   1. The control unit shall derive its normal power from a 120 volt, 60 Hz dedicated supply connected to the emergency power system. Standby power shall be provided by a 24 volt DC battery as hereinafter specified. The normal power shall be

transformed, rectified, coordinated, and interfaced with the standby battery and charger.

2. The door holder power shall be arranged so that momentary or sustained loss of main operating power shall not cause the release of any door.
3. Power supply for smoke detectors shall be taken from the fire alarm control unit.
4. Provide protectors to protect the fire alarm equipment from damage due to lightning or voltage and current transients.
5. Provide new separate and direct ground lines to the outside to protect the equipment from unwanted grounds.

E. Circuit Supervision: Each alarm initiating device circuit, signaling line circuit, and notification appliance circuit, shall be supervised against the occurrence of a break or ground fault condition in the field wiring. These conditions shall cause a trouble signal to sound in the control unit until manually silenced by an off switch.

F. Supervisory Devices: All sprinkler system valves, standpipe control valves, post indicator valves (PIV), and main gate valves shall be supervised for off-normal position. Closing a valve shall sound a supervisory signal at the control unit until silenced by an off switch. The specific location of all closed valves shall be identified at the control unit. Valve operation shall not cause an alarm signal. Low air pressure switches and duct detectors shall be monitored as supervisory signals. The power supply to the elevator shunt trip breaker shall be monitored by the fire alarm system as a supervisory signal.

G. Trouble signals:
   1. Arrange the trouble signals for automatic reset (non-latching).
   2. System trouble switch off and on lamps shall be visible through the control unit door.

H. Function Switches: Provide the following switches in addition to any other switches required for the system:
   1. Remote Alarm Transmission By-pass Switch: Shall prevent transmission of all signals to the main fire alarm control unit when in the "off" position. A system trouble signal shall be energized when switch is in the off position.
   2. Alarm Off Switch: Shall disconnect power to alarm notification circuits on the local building alarm system. A system trouble signal shall be activated when switch is in the off position.
   3. Trouble Silence Switch: Shall silence the trouble signal whenever the trouble silence switch is operated. This switch shall not reset the trouble signal.

4. Reset Switch: Shall reset the system after an alarm, provided the initiating device has been reset. The system shall lock in alarm until reset.
5. Lamp Test Switch: A test switch or other approved convenient means shall be provided to test the indicator lamps.
6. Drill Switch: Shall activate all notification devices without tripping the remote alarm transmitter. This switch is required only for general evacuation systems specified herein.
7. Door Holder By-Pass Switch: Shall prevent doors from releasing during fire alarm tests. A system trouble alarm shall be energized when switch is in the abnormal position.
8. Elevator recall By-Pass Switch: Shall prevent the elevators from recalling upon operation of any of the devices installed to perform that function. A system trouble alarm shall be energized when the switch is in the abnormal position.
9. HVAC/Smoke Damper By-Pass: Provide a means to disable HVAC fans from shutting down and/or smoke dampers from closing upon operation of an initiating device designed to interconnect with these devices.

I. Remote Transmissions:
   1. Provide capability and equipment for transmission of alarm, supervisory and trouble signals to the main fire alarm control unit.
   2. Transmitters shall be compatible with the systems and equipment they are connected to such as timing, operation and other required features.

J. Remote Control Capability: Each building fire alarm control unit shall be installed and programmed so that each must be reset locally after an alarm, before the main fire alarm control unit can be reset. After the local building fire alarm control unit has been reset, then the all system acknowledge, reset, silence or disabling functions can be operated by the main fire alarm control unit

K. System Expansion: Design the control units and enclosures so that the system can be expanded in the future (to include the addition of 20 percent more alarm initiating, alarm notification and door holder circuits) without disruption or replacement of the existing control unit and secondary power supply.

2.4 STANDBY POWER SUPPLY

A. Uninterrupted Power Supply (UPS):
   1. The UPS system shall be comprised of a static inverter, a precision battery float charger, and sealed maintenance free batteries.
   2. Under normal operating conditions, the load shall be filtered through a ferroresonant transformer.
   3. When normal AC power fails, the inverter shall supply AC power to the transformer from the battery source. There shall be no break in output of the system during transfer of the system from normal to battery supply or back to normal.
   4. Batteries shall be sealed, gel cell type.
   5. UPS system shall be sized to operate the central processor, CRT, printer, and all other directly connected equipment for 5 minutes upon a normal AC power failure.

B. Batteries:
   1. Battery shall be of the sealed, maintenance free type, 24-volt nominal.
   2. Battery shall have sufficient capacity to power the fire alarm system for not less than 24 hours plus 5 minutes of alarm to an end voltage of 1.14 volts per cell, upon a normal AC power failure.
   3. Battery racks shall be steel with an alkali-resistant finish. Batteries shall be secured in seismic areas 2B, 3, or 4 as defined by the Uniform Building Code.

C. Battery Charger:
   1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120-volt, 60 hertz emergency power source.
   2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.
   3. Shall have protection to prevent discharge through the charger.
   4. Shall have protection for overloads and short circuits on both AC and DC sides.
   5. A trouble condition shall actuate the fire alarm trouble signal.
   6. Charger shall have automatic AC line voltage regulation, automatic current-limiting features, and adjustable voltage controls.

2.5 ANNUNCIATION

A. Annunciator, Alphanumeric Type (System):
   1. Shall be a supervised, LCD display containing a minimum of 2 lines of 40 characters for alarm annunciation in clear English text.
   2. Message shall identify building number, floor, zone, etc on the first line and device description and status (pull station, smoke detector, and waterflow alarm or trouble condition) on the second line.
   3. The initial alarm received shall be indicated as such.
   4. A selector switch shall be provided for viewing subsequent alarm messages.
   5. The display shall be UL listed for fire alarm application.
   6. Annunciators shall display information for all buildings connected to the system. Local building annunciators, for general evacuation system buildings, shall be permitted when shown on the drawings and approved by the OWNER.

2.6 ALARM NOTIFICATION APPLIANCES

A. Strobes:
   1. Xenon flash tube type minimum 15 candela in toilet rooms and 75 candela in all other areas with a flash rate of 1 HZ. Strobes shall be synchronized where required by the National Fire Alarm Code (NFPA 72).
   2. Backplate shall be red with 1/2 inch (13 mm) permanent red letters. Lettering to read "Fire", be oriented on the wall or ceiling properly, and be visible from all viewing directions.
   3. Each strobe circuit shall have a minimum of 20 percent spare capacity.
   4. Strobes may be combined with the audible notification appliances specified herein.
B. Fire Alarm Horns:
   1. Shall be electric, utilizing solid state electronic technology operating on a nominal 24 VDC.
   2. Shall be a minimum nominal rating of 80 dBA at 10 feet (3,000 mm).
   3. Mount on removable adapter plates on conduit boxes.
   4. Horns located outdoors shall be of weatherproof type with metal housing and protective grille.

5. Each horn circuit shall have a minimum of 20 percent spare capacity.

2.7 ALARM INITIATING DEVICES

A. Manual Fire Alarm Stations:
   1. Shall be non-breakglass, address reporting type.
   2. Station front shall be constructed of a durable material such as cast or extruded metal or high impact plastic. Stations shall be semi-flush type.
   3. Stations shall be of single action pull down type with suitable operating instructions provided on front in raised or depressed letters, and clearly labeled "FIRE."
   4. Operating handles shall be constructed of a durable material. On operation, the lever shall lock in alarm position and remain so until reset. A key shall be required to gain front access for resetting, or conducting tests and drills.
   5. Unless otherwise specified, all exposed parts shall be red in color and have a smooth, hard, durable finish.
   6. Stations identified as key operated only shall have a single standardized lock and key separate from the control equipment.

B. Smoke Detectors:
   1. Smoke detectors shall be photoelectric type and UL listed for use with the fire alarm control unit being furnished.
   2. Smoke detectors shall be addressable type complying with applicable UL Standards for system type detectors. Smoke detectors shall be installed in accordance with the manufacturer's recommendations and NFPA 72.
   3. Detectors shall have an indication lamp to denote an alarm condition. Provide remote indicator lamps and identification plates where detectors are concealed from view. Locate the remote indicator lamps and identification plates flush mounted on walls so they can be observed from a normal standing position.
   4. All spot type and duct type detectors installed shall be of the photoelectric type.
   5. Photoelectric detectors shall be factory calibrated and readily field adjustable. The sensitivity of any photoelectric detector shall be factory set at 3.0 plus or minus 0.25 percent obscuration per foot.
   6. Detectors shall provide a visual trouble indication if they drift out of sensitivity range or fail internal diagnostics. Detectors shall also provide visual indication of sensitivity

level upon testing. Detectors, along with the fire alarm control units shall be UL listed for testing the sensitivity of the detectors.

C. Heat Detectors:
   1. Heat detectors shall be of the addressable restorable rate compensated fixed-temperature spot type.
   2. Detectors shall have a minimum smooth ceiling rating of 2,500 square feet (230 square meters).
   3. Ordinary temperature (135 degrees F (57 degrees C)) heat detectors shall be utilized in all areas.
   4. Provide a remote indicator lamp, key test station and identification nameplate (e.g. “Heat Detector - Elevator P-_____) for each elevator group. Locate key test station in plain view on elevator machine room wall.

D. Water Flow and Pressure Switches:
   1. Wet pipe water flow switches and dry pipe alarm pressure switches for sprinkler systems shall be connected to the fire alarm system by way of an address reporting interface device.
   2. All new water flow switches shall be of a single manufacturer and series and non-accumulative retard type. See Section 21 12 00, FIRE-SUPPRESSION STANDPIPES and Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches added. Connect all switches shown on the approved shop drawings.
   3. All new switches shall have an alarm transmission delay time that is conveniently adjustable from 0 to 60 seconds. Initial settings shall be 30-45 seconds. Timing shall be recorded and documented during testing.

2.8 SUPERVISORY DEVICES

A. Duct Smoke Detectors:
   1. Duct smoke detectors shall be provided and connected by way of an address reporting interface device. Detectors shall be provided with an approved duct housing mounted exterior to the duct, and shall have perforated sampling tubes extending across the full width of the duct (wall to wall). Detector placement shall be such that there is uniform airflow in the cross section of the duct.

2. Interlocking with fans shall be provided in accordance with NFPA 90A and as specified hereinafter under Part 3.2, "TYPICAL OPERATION".
3. Provide remote indicator lamps, key test stations and identification nameplates (e.g. "DUCT SMOKE DETECTOR AHU-X") for all duct detectors. Locate key test stations in plain view on walls or ceilings so that they can be observed and operated from a normal standing position.

B. Sprinkler and Standpipe System Supervisory Switches:
1. Each sprinkler system water supply control valve, riser valve or zone control valve, and each standpipe system riser control valve shall be equipped with a supervisory switch. Standpipe hose valves, and test and drain valves shall not be equipped with supervisory switches.
2. PIV (post indicator valve) or main gate valve shall be equipped with a supervisory switch.
3. Valve supervisory switches shall be connected to the fire alarm system by way of address reporting interface device. See Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS for new switches to be added. Connect tamper switches for all control valves shown on the approved shop drawings.
4. The mechanism shall be contained in a weatherproof die-cast aluminum housing that shall provide a 3/4 inch (19 mm) tapped conduit entrance and incorporate the necessary facilities for attachment to the valves.
5. The entire installed assembly shall be tamper-proof and arranged to cause a switch operation if the housing cover is removed or if the unit is removed from its mounting.
6. Where dry-pipe sprinkler systems are installed, high and low air pressure switches shall be provided and monitored by way of an address reporting interface devices.

2.09 ADDRESS REPORTING INTERFACE DEVICE

A. Shall have unique addresses that reports directly to the building fire alarm panel.
B. Shall be configurable to monitor normally open or normally closed devices for both alarm and trouble conditions.
C. Shall have terminal designations clearly differentiating between the circuit to which they are reporting from and the device that they are monitoring.

D. Shall be UL listed for fire alarm use and compatibility with the panel to which they are connected.
E. Shall be mounted in weatherproof housings if mounted exterior to a building.

2.10 SMOKE BARRIER DOOR CONTROL

A. Electromagnetic Door Holders:
    1. New Door Holders shall be standard wall mounted electromagnetic type. In locations where doors do not come in contact with the wall when in the full open position, an extension post shall be added to the door bracket.
    2. Operation shall be by 24 volt DC supplied from a battery located at the fire alarm control unit. Door holders shall be coordinated as to voltage, ampere drain, and voltage drop with the battery, battery charger, wiring and fire alarm system for operation as specified.
B. A maximum of twelve door holders shall be provided for each circuit. Door holders shall be wired to allow releasing doors by smoke zone.
C. Door holder control circuits shall be electrically supervised.
D. Smoke detectors shall not be incorporated as an integral part of door holders.

2.11 UTILITY LOCKS AND KEYS:

A. All key operated test switches, control units, annunciator panels and lockable cabinets shall be provided with a single standardized utility lock and key.
B. Key-operated manual fire alarm stations shall have a single standardized lock and key separate from the control equipment.
C. All keys shall be delivered to the Owner.

2.12 INSTRUCTION CHART:

Provide typewritten instruction card mounted behind a Lexan plastic or glass cover in a stainless steel or aluminum frame with a backplate. Install the frame in a conspicuous location observable from each control unit where operations are performed. The card shall show those steps to be taken by an operator when a signal is received under all conditions, normal, alarm, supervisory, and trouble. Provide an additional copy with the

binder for the input output matrix for the sequence of operation. The instructions shall be approved by the Owner before being posted.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with NFPA 70, 72, 90A, and 101 as shown on the drawings, and as recommended by the major equipment manufacturer. Fire alarm wiring shall be installed in conduit. All conduit and wire shall be installed in accordance with, Section 26 05 33and all penetrations of smoke and fire barriers shall be protected as required by Section 07 84 00, FIRESTOPPING.
B. All conduits, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas.
C. All new and reused exposed conduits shall be painted in accordance with Section 09 91 00, PAINTING to match surrounding finished areas and red in unfinished areas.
D. Existing devices that are reused shall be properly mounted and installed. Where devices are installed on existing shallow backboxes, extension rings of the same material, color and texture of the new fire alarm devices shall be used. Mounting surfaces shall be cut and patched in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Restoration, and be re-painted in accordance with Section 09 91 00, PAINTING as necessary to match existing.
E. All fire detection and alarm system devices, control units and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas. Exact locations are to be approved by the OWNER.
F. Chime/Strobes shall be ceiling mounted and fully recessed in areas with suspended ceilings. Chimes shall be wall mounted and recessed in finished areas without suspended ceilings. Speakers may be surface mounted in unfinished areas.
G. Manual pull stations shall be installed not less than 42 inches (1,050 mm) or more than 48 inches (1,200 mm) from finished floor to bottom of device and within 60 inches (1,500 mm) of a stairway or an exit door.

H. Where possible, locate water flow and pressure switches a minimum of 12 inches (300 mm) from a fitting that changes the direction of the flow and a minimum of 36 inches (900 mm) from a valve.

I. Mount valve tamper switches so as not to interfere with the normal operation of the valve and adjust to operate within 2 revolutions toward the closed position of the valve control, or when the stem has moved no more than 1/5 of the distance from its normal position.

J. Connect flow and tamper switches installed under Section 21 13 13, WET-PIPE SPRINKLER SYSTEMS.

K. Connect combination closer-holders installed under Section 08 71 00, DOOR HARDWARE.

3.2 TYPICAL OPERATION

A. Activation of any manual pull station, water flow or pressure switch, heat detector, kitchen hood suppression system, gaseous suppression system, or smoke detector shall cause the following operations to occur:
   1. . For sprinkler protected buildings, flash strobes continuously only in the zone of alarm. For buildings without sprinkler protection throughout, flash strobes continuously only on the floor of alarm.
   2. Continuously sound a temporal pattern general alarm and flash all strobes in the building in alarm until reset at the local fire alarm control unit in Buildings.
   3. Release only the magnetic door holders in the smoke zone after the alert signal.
   4. Transmit a separate alarm signal, via the main fire alarm control unit to the fire department.
   5. Unlock the electrically locked exit doors within the zone of alarm.

B. Heat detectors in elevator machine rooms shall, in addition to the above functions, disconnect all power to all elevators served by that machine room after a time delay. The time delay shall be programmed within the fire alarm system programming and be equal to the time it takes for the car to travel from the highest to the lowest level, plus 10 seconds.

C. Operation of a smoke detector at a corridor door used for automatic closing shall also release only the magnetic door holders in that smoke zone. Operation of a smoke

detector at a shutter used for automatic closing shall also release only the shutters in that smoke zone.

D. Operation of duct smoke detectors shall cause a system supervisory condition and shut down the ventilation system and close the associated smoke dampers as appropriate.
E. Operation of any sprinkler or standpipe system valve supervisory switch, high/low air pressure switch, or fire pump alarm switch shall cause a system supervisory condition.
F. Alarm verification shall not be used for smoke detectors installed for the purpose of early warning.

3.3 TESTS

A. Provide the service of a NICET level III, competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the Owner.
B. When the systems have been completed and prior to the scheduling of the final inspection, furnish testing equipment and perform the following tests in the presence of the Owner. When any defects are detected, make repairs or install replacement components, and repeat the tests until such time that the complete fire alarm systems meets all contract requirements. After the system has passed the initial test and been approved by the Owner, the contractor may request a final inspection.
    1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
    2. Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
    3. Run water through all flow switches. Check time delay on water flow switches. Submit a report listing all water flow switch operations and their retard time in seconds.
    4. Open each alarm initiating and notification circuit to see if trouble signal actuates.
    5. Ground each alarm initiation and notification circuit and verify response of trouble signals.

3.4 FINAL INSPECTION AND ACCEPTANCE

A. Prior to final acceptance a minimum 30 day "burn-in" period shall be provided. The purpose shall be to allow equipment to stabilize and potential installation and software problems and equipment malfunctions to be identified and corrected. During this diagnostic period, all system operations and malfunctions shall be recorded. Final acceptance will be made upon successful completion of the "burn-in" period and where the last 14 days is without a system or equipment malfunction.
B. At the final inspection a factory trained representative of the manufacturer of the major equipment shall repeat the tests in Article 3.3 TESTS and those required by NFPA 72. In addition the representative shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of an Architect representative.

3.5 INSTRUCTION

A. The manufacturer's authorized representative shall provide instruction and training to the Owner as follows:
   1. Two 4-hour sessions to staff for detailed operation of the system.
B. The Contractor and/or the Systems Manufacturer's representative shall provide a typewritten "Sequence of Operation" including a trouble shooting guide of the entire system for submittal to the Architect. The sequence of operation will be shown for each input in the system in a matrix format and provided in a loose leaf binder. When reading the sequence of operation, the reader will be able to quickly and easily determine what output will occur upon activation of any input in the system. The INPUT/OUTPUT matrix format shall be as shown in Appendix A to NFPA 72.
C. Furnish the services of a competent instructor for instructing personnel in the programming requirements necessary for system expansion. Such programming shall include addition or deletion of devices, zones, indicating circuits and printer/display text.

END OF SECTION 28 31 00

SECTION 33 61 16

EARTHQUAKE DRAINS

PART 1 - GENERAL

1.01 SUMMARY

A. Liquefaction Mitigation with Prefabricated Vertical Drains with Filter Fabric (Earthquake Drains).

B. This work shall consist of furnishing all necessary submittals, materials, labor, equipment, and incidentals for the delegated design and installation of a plurality of substantially vertical prefabricated earthquake ("EQ") drains, positioned at spaced intervals in the liquefiable soil and the associated reservoirs for draining off water which is expelled from the drains during an earthquake.

C. The EQ drains consist of a corrugated pipe with slot type perforations encased by a geotextile filter fabric (jacket material). The space within the pipes above the ground water table provides a reservoir for water expelled from the ground for liquefaction mitigation.

D. The required reservoir will consist of either a naturally occurring highly permeable soil underlying or overlying the treated liquefiable soil, a layer of highly permeable soil applied over the liquefiable soil or the space within the corrugated pipes above the ground water table.

E. The drains shall be installed substantially vertically and penetrate fully the liquefiable soil to a depth as determined by the EQ drain engineer. The drains shall be spaced in the range of approximately 2 to 6 feet from each other as required by the EQ drain engineer.

F. The design of the drain installation area should include the area under the entire building footprint and at least 10 feet outside.

G. The insertion of the drains will result in densification of the liquefiable soils further reducing the liquefaction potential.

H. The liquefiable soils to be treated will have permeabilities as shown in the geotechnical report.

I. Design must be based on established parameters in the FEQDrain Design Manual including, but not limited to, number of cycles to liquefaction, coefficient of volumetric compressibility (mv), hydraulic conductivity (k), equivalent number of cycles due to earthquake loading, and duration of earthquake strong motions.

J. Install the EQ drains to full length without splicing.

K. The earthquake drain system shall be designed to mitigate liquefaction and to minimize seismic settlements to one inch (1.0") or less and a pore pressure ration (r_d) to 0.65 or less for the design earthquake.

1.02 PERFORMANCE REQUIREMENTS

A. Delegated Design: Earthquake Drains

1.03 STANDARDS

A. American Society for Testing and Material (ASTM)

a. ASTM D3776 Standard Test Method for Measuring Mass per Unit Area of Geotextiles

b. ASTM D3786 Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics – Diaphragm Bursting Strength Tester Method

c. ASTM D4491 Standard Test Method for Water Permeability of Geotextiles by Permittivity

d. ASTM D4533 Standard Test Method for Trapezoid Tearing Strength of Geotextiles

e. ASTM D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

f. ASTM D4833 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products

1.04 QUALITY CONTROL

A. The earthquake drains shall be installed with equipment that will maintain the mandrel in a vertical position.

B. The Contractor shall consider the subsoils at the site when selecting equipment and developing the earthquake drain installation plan.

C. The equipment shall generate sufficient pressure necessary to install the earthquake drains through all existing subsurface material to the depths shown on the plans. The equipment shall have the capability of installing the earthquake drains to a depth of not less than four feet greater than the maximum earthquake drain depth shown on the plans.

D. Approval of the sample earthquake drain material by the Architect/Engineer will be required prior to delivery of the earthquake drain material to the Project.

E. The earthquake drain manufacturer shall be a specialist in the manufacture of earthquake drains and shall have produced a minimum of 1,000,000 linear feet of the earthquake drain material proposed for the Project, that have been used in successful applications within the past five years.

F. The Contractor shall certify and provide proof to the Engineer of experience in the work described. The Contractor shall have successfully installed at least 3,000,000 linear feet of vertical drains for mitigating liquefaction during the last ten years.

G. In addition, the Contractor shall have successfully completed at least five projects within the last five years of similar size and complexity to that of the Project.

   a. The Contractor's experience shall be documented by providing a project summary that includes for each referenced project, the project start and completion dates, total quantity of earthquake drains installed, and a detailed description of the project, site conditions, and subsurface conditions.

   b. The project description shall include details of the earthquake drain materials, the equipment and technique used to install the earthquake drains, the average and maximum length of earthquake drain installed, the client name and address, the name and telephone number of the representative of the consultant and owner for whom the work was performed and who can attest to the successful completion of the work, and any other information relevant to demonstrating the Contractor's qualifications.

H. The Contractor shall have a full-time supervisor who has been in responsible charge of supervising earthquake drain installation operations for at least five projects in the last five years. The supervisor shall be present at the work site at all times during earthquake drain installation operations. The acceptability of the supervisor, as well as any replacement for the supervisor, will be subject to the approval of the Engineer.

1.05 SUBMITTALS

B. Earthquake Drain (Prefabricated Vertical Drain for Liquefaction Mitigation) Plan: Within thirty (30) calendar days after award of the contract or no later than thirty (30) calendar days before beginning earthquake drain installation, the Contractor shall submit to the Engineer for review an installation plan, sealed by a registered professional engineer in the state of North Carolina, for prefabricated vertical drains for liquefaction mitigation that includes as a minimum the following information:

   a. Describe the EQ drain assembly procedures/process.

   b. The configuration of the installation equipment including size, type, weight, maximum

c. pushing force, vibratory hammer rated energy and configuration of the installation rig.

d. Dimensions and length of the mandrel.

e. Details of earthquake drain anchorage.

f. Detailed description of proposed installation procedures.

g. Proposed methods and equipment for pre-augering or spudding.

h. Documentation of the successful application of the proposed earthquake drain installation operations.

i. Method of measuring the installed length of the earthquake drain.

j. Sealed shop drawings, including calculations, showing the planned locations and bottom elevations of all earthquake drains and showing a unique identification number for each earthquake drain. Design calculations shall include the FEQDrain output file including the input parameters used to calculate design spacing. The installation sequence shall also be provided. The shop drawings shall also show the location of existing structures, if present in the vicinity of the proposed treatment area.

k. Resume of supervisor documenting experience and qualifications in the installation of earthquake drains.

1.06 SUBMITTAL REVIEWS

A. Prefabricated Vertical Drain with Filter Fabric Material: At least thirty (30) calendar days before beginning earthquake drain installation, the Contractor shall:

a. Submit to the Engineer for review, three samples of the earthquake drain material to be used, with the accompanying manufacturer specifications for the earthquake drain material. The samples of the earthquake drain shall be at least five feet long. The samples shall be stamped or labeled by the manufacturer as being representative of the earthquake drain material having its specified trade name.

b. Submit to the Engineer three samples of the proposed anchor plate to be used to anchor the earthquake drains at the design depth shown on the plans.

c. Submit to the Engineer manufacturer's literature documenting the physical and mechanical properties of the earthquake drain components.

d. The Contractor shall identify the proposed source of the materials prior to delivery to the site. The Contractor shall supply a manufacturer's material certification that the earthquake drain with filter fabric meets or exceeds the material requirements of this specification.

B. The submittals shall be reviewed and accepted or rejected within twenty-one (21) calendar days of receipt by the Engineer.

C. Acceptance of the proposed materials, equipment, construction sequence shall not relieve the Contractor of its responsibility to install the earthquake drains in accordance with his delegated design plans and specifications.

D. Approval by the Engineer of the method and equipment to be used to install the earthquake drains shall be contingent upon satisfactory demonstration of earthquake drain installation at the project site. If, at any time, the Engineer considers that the method of installation does not produce satisfactory earthquake drains, the Contractor shall alter the method and/or equipment as necessary to comply with the specifications.

E. The Engineer and Geotechnical Engineer will be the sole judge in determining the adequacy of the Contractor's methods and equipment.

1.07 AS-BUILT PLANS

A. The Contractor shall provide the Engineer with “as-built” plans of the earthquake drain installation. Such plans shall include the locations of the earthquake drains, the date the drains were installed and shall identify any rejected or abandoned drain installations.

B. Progress “As-built” plans shall be submitted at least weekly during earthquake drain installation operations.

C. A final “as-built” plan shall be submitted within seven calendar days of the completion of earthquake drain installation.

D. The final “as-built” plans will be subject to the approval of the Engineer and Geotechnical Engineer of Record.

PART 2 – PRODUCTS

2.01 MATERIALS

A. The earthquake drain materials shall consist of newly manufactured materials and shall consist of an annular-corrugated interior and exterior plastic drainage core wrapped in a non-woven geotextile drainage fabric jacket.

B. The pipe material shall consist of a continuous high-density polyethylene pipe with slot type perforations and shall provide continuous vertical drainage and shall provide drainage through slot type perforations with a reservoir available in the space above the ground water table.

C. The drainage fabric jacket shall allow free passage of pore water to the core without loss of soil material or piping.

D. The artificial reservoir space may take any of several forms, ranging from a layer of open graded stone bridge applied over the area receiving EQ drains, to the void space above the groundwater table in each individual drain with final design and determination by the EQ drain engineer.

E. The drainage fabric jacket components shall conform to the following:

a. The drainage fabric jacket shall be synthetic, non-woven polymeric geotextile material, capable of resisting bending, punching and tensile forces imposed during installation and during the design life of the earthquake drain meeting the requirements in Table 1.

b. The drainage fabric jacket shall not be subject to localized damage (e.g., punching through the filter by sand/gravel particles).

c. The drainage fabric jacket shall be rigid enough to withstand lateral earth pressures due to embedment and surcharge so that the vertical flow capacity through the core will not be adversely affected.

d. The drainage fabric jacket shall be flexible enough to bend smoothly during installation and induced densification without damage.

e. The drainage fabric jacket shall not undergo cracking and peeling during installation of the earthquake drain.

Table 1 – Jacket Material Properties

PROPERTY[1]	TEST METHODS	UNITS	REQUIREMENTS
Mass	ASTM D5261	oz./yd^2	≥ 3.5
Grab Elongation	ASTM D4632	%	≥ 50
Grab Strength	ASTM D4632	lbs.	≥ 95
Tear Strength	ASTM D4533	lbs.	≥ 50
Puncture Strength	ASTM D6241	lbs.	≥ 35
Permittivity	ASTM D4491	sec.$^{-1}$	≥ 0.5
AOS	ASTM D4751	Sieve Size (mm)	#70 (≤ 0.15)

Notes:
[1]All numeric values represent Minimum Average Roll Value (MARV) in the weaker principal direction. Provide geotextiles whose average test results from any roll sampled in a lot for conformance or quality assurance testing meets or exceeds minimum values provided in this Table.

F. Core Materials: The core materials shall conform to the following:

a. The core shall be continuous high-density polyethylene (HDPE) annular-corrugated interior and exterior pipe with slot type perforations to promote drainage along the axis meeting the requirements of Table 2.

b. The HDPE shall meet the requirements of ASTM D3350 Cell Classification 424420C. The carbon black content for this pipe shall range from 2 to 4 percent.

Table 2 – Core Material Properties

PROPERTY	TEST METHODS	UNITS	REQUIREMENTS
Nominal Inside Diameter	ASTM F405	in.	As shown
Minimum Average Wall Thickness	Measured with caliper	in.	0.042
Minimum Pipe Stiffness @ 5% Deflection	ASTM F405	psi	30
Elongation	ASTM F405	%	5
Minimum Drainage Slot Area	ASTM F405	ft^2/ft	0.013

2.02 EQ DRAIN ASSEMBLIES

A. The assembled earthquake drain shall be resistant against wet rot, mildew, bacterial action, insects, salts in solution in the ground water, acids, alkalis, solvents, and other ingredients in the site ground water.

B. Earthquake drain materials shall be labeled or tagged in such a manner that the information for sample identification and other quality control purposes can be read from the label. As a minimum, identify each roll of material whether jacket or core material used to manufacture the EQ drains by the manufacturer of the material as to lot or control numbers, individual roll number, date of manufacture, manufacturer and product identification.

C. The jacket materials shall be free of defects, rips, holes, and/or flaws.

D. The core materials will be free of defects, crimps, kinks, crushed sections and/or other flaws.

E. Do not use any materials in the work which are damaged during shipment, unloading, storage, or handling, or do not otherwise meet these Specifications.

F. The jacket and core materials shall be wrapped in a protective covering (burlap or similar heavy duty protective covering) during shipment to the project site and during storage until installation.

G. Material which is damaged during shipment, unloading, storage, or handling, or which does not meet the requirements of the earthquake drain material will be rejected by the Engineer. No payment will be made for rejected material.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Earthquake drains shall be installed & spaced as indicated on the approved installation plans.

B. Earthquake drains shall be installed in stages coinciding with construction stages.

C. Earthquake drains shall be installed using a mandrel or a sleeve that shall advance through the soils to the elevations shown on the plans. The earthquake drains shall be installed using equipment that will maintain the mandrel in a vertical position. The mandrel or sleeve shall protect the drain material from tears, cuts, and abrasion during installation and shall be retracted after each earthquake drain is installed. The mandrel shall be fitted with three symmetrically spaced fins for transmitting vibrations to the soil during installation.

D. The installation rig shall utilize a vibrator with an eccentric moment sufficient to generate vertical vibration to the mandrel during installation. The equipment shall also generate sufficient vertical force (static crowd) to the mandrel to install the earthquake drains through all existing subsurface materials to the depths shown on the plans.

E. The earthquake drain shall be provided with an “anchor” plate or similar arrangement to anchor the bottom of the drain at the required depth during mandrel removal and to prevent soil from entering the bottom of the mandrel during drain installation. The anchorage shall be adequate to keep the bottom of the earthquake drain at the required depth subject to approval and field verification by the Engineer. The corresponding dimension of the anchor shall conform as closely as possible to the breadth dimensions of the mandrel to minimize soil disturbance.

F. The Contractor shall notify the Engineer at least 24 hours prior to installation of the initial earthquake drains, to allow the Engineer sufficient time to provide the necessary inspection for the initial earthquake drain installation along with the EQ Drain Engineer. Installation of the initial earthquake drains shall not proceed without the presence of the Engineer or Geotechnical Engineer and EQ Drain Engineer and Special Inspector. During the installation of the initial ten (10) earthquake drains, the Contractor shall demonstrate that the equipment, method, and material produce a satisfactory installation. Following completion of the initial earthquake drain installations, the Contractor shall not proceed with the installation of the remaining earthquake drains until authorized by the Engineer or Geotechnical Engineer.

G. If foundations have been previously installed, the prefabricated earthquake drains shall be installed in a manner as to avoid foundation piles or spread footings. The location of the earthquake drains relative to the foundations shall be determined and staked out prior to the installation of the prefabricated earthquake drains. In addition, the Contractor shall be responsible for taking precautions to preserve the stake locations and is responsible for re-staking, if necessary.

H. Earthquake drains shall be located, numbered, and staked out using a baseline and benchmark provided by the Contractor. The Contractor shall be responsible for all other construction staking, for taking precautions to preserve the stake locations, and is responsible for re-staking, if necessary. The as-installed locations of the earthquake drains shall not vary by more than six inches from the locations designated on the plans or approved shop drawings.

I. Earthquake drains that deviate from the plan locations by more than six inches, that are damaged, or improperly installed will be rejected. Rejected earthquake drains shall be abandoned in place. Replacement earthquake drains shall be placed as close as possible to the correct original locations.

J. The Contractor shall provide the Engineer or Geotechnical Engineer with a means of verifying the plumbness of the mandrel and determining the depth of the earthquake drains. The equipment shall be checked for plumbness prior to installing each drain and shall not deviate from the vertical more than two percent (2%) during installation.

K. Earthquake drains shall be installed as shown on the plans and as directed by the Engineer. The replacement of existing geotechnical instrumentation damaged because of the Contractor's activities will be the responsibility of the Contractor, as described in the Special Provision for the geotechnical instrumentation.

L. Earthquake drains shall be installed from the working surface to the earthquake drain bottom elevations or depths shown on the plans or to refusal. Refusal shall be defined as a mandrel penetration rate of less than 3" per second with the equipment's full vibration and static crowd.

M. The refusal criteria shall be verified by the Geotechnical Engineer if encountered. No earthquake drains shall be terminated above the design earthquake drain bottom elevations shown on the plans without the approval of the EQ Drain Engineer. The EQ Drain Engineer may vary the depths of earthquake drains to be installed and may revise the plan limits for this work based on the actual subsurface conditions encountered.

N. The prefabricated earthquake drains shall be cut off neatly at least six inches above the working layer, unless otherwise shown on the plans. The filter fabric shall be knotted at the top of the drain to prevent soil from entering the drain.

O. During earthquake drain installation, the Contractor shall provide the Engineer and Special Inspector with a means of determining the depth of the advancing earthquake drain at any given time and the length of the drain installed at each location.

P. Where obstructions are encountered below the working surface, the Contractor shall install a new drain within an 18-inch radius of the original location of the obstructed drain. A maximum of two additional attempts shall be made as directed by the EQ Drain Engineer for each obstructed earthquake drain. If the drain still cannot be installed to the design tip elevation, the drain location shall be abandoned and a new drain installed at a location directed by the EQ Drain Engineer. Locations where earthquake drains do not meet the depth criteria due to obstructions shall be clearly marked in the field. The EQ Drain Engineer will have the right to waive the replacement earthquake drain requirement upon written notice to the Contractor.

Q. Pre-augering for the earthquake drain installation shall be allowed to advance the drains through compacted fill, dense near surface soils and/or other obstructions. The Contractor shall be responsible for penetrating the overlying fill material or any dense layers or obstructions when encountered to satisfactorily install the earthquake drains. Satisfactory installation shall allow for clearing obstructions defined as any man-made or natural object or a stratum that prevents the proper insertion of the mandrel and installation of the earthquake drain.

R. The Contractor may use augering or other approved methods to loosen the soil and obstructing material prior to the installation of the drains. The obstruction clearance procedure is subject to the approval of the EQ Drain Engineer; however, such approval shall not relieve the Contractor of the responsibility to clear obstructions in accordance with the specifications.

S. If augering is the selected method, the augers shall have a minimum outside diameter equal to the largest horizontal dimension of the mandrel or anchor, whichever is greatest. The maximum outside diameter of the auger shall be no more than three inches greater than the maximum dimension of the mandrel.

T. Obstruction clearance procedures shall be kept to a minimum and shall be used only when approved by the EQ Drain Engineer. Augering or other obstruction removal techniques shall not penetrate more than two feet into the underlying compressible soil.

U. Where obstructions are encountered, the following procedure shall be implemented in the listed sequence:

    a. The Contractor shall immediately notify the EQ Drain Engineer prior to completing the drain and prior to installing other drains.

b. The Contractor shall then attempt to install drains adjacent to the obstructed location. Based upon the results of these installations and at the direction of the EQ Drain Engineer, the Contractor shall:

i. Attempt to install an offset drain within 18 inches horizontally of the obstructed drain, or

ii. Implement obstruction clearance procedures and install the drain at the design location. Obstruction clearance procedures shall be used only as approved by the EQ Drain Engineer.

V. Earthquake drains shall be installed using a continuous push using static weight and vibration. Jetting or the use of an impact hammer will not be allowed to install the earthquake drains.

W. A mandrel shall be used to protect the earthquake drains during installation. The mandrel shall be withdrawn after installation of the earthquake drains. In no case will alternative raising and lowering of the mandrel during advancement be permitted. Raising the mandrel will be permitted only after completion of the earthquake drain installation to the bottom of the drain elevation shown on the plans or otherwise authorized by the EQ Drain Engineer.

3.02 PREFABRICATED EQ DRAINS PAYMENT

A. Payments for earthquake drains shall be made at the at the contract lump sum, which price shall be full compensation for the cost of furnishing the full length the earthquake drain material, installing the earthquake drain, obstruction clearance, altering of the equipment and methods of installation in order to produce the required end result in accordance with contract documents, and shall also include the cost of furnishing all tools, mobilization, materials, labor, equipment, supervision, survey stake out of the earthquake drain locations, and all other costs necessary to complete the required work.

B. The EQ Drain Engineer may vary the depths, spacing or numbers of the earthquake drains to be installed and may revise the earthquake drain installation limits shown on the plans based on the actual subsurface conditions encountered. Such changes or revision may increase or decrease the total quantity of the earthquake drains estimated based on the plans. In the event such changes in required earthquake drain quantity, the Contractor shall allow for a deduction or credit to the Owner.

END OF SECTION